VOLUME 5 OCTOBER 4, 1899 NUMBER 1

The Horseless Age

EVERY WEDNESDAY

In the Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

5-6
1899-1900

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

Complete Lines of UPRIGHT DRILLS

From a light Friction Drill to a 42-in. B. G. P. F. Drill.

SEND FOR CATALOGUE.

W. F. and John Barnes Co.,

996 Ruby Street, = Rockford, Ill.

WE can make immediate delivery of our high-grade compound, 4, 6 and 8 H. P. reversing motor carriage engines, weighing 60 pounds, making from 200 to 600 revolutions; and our 6 and 8 H. P. copper-tube shell boilers, weighing 100 pounds; 15 inches high and 15 inches in diameter; 150 to 300 pounds pressure. Also our patent automatic burner; from 1 to 100 H. P., weighing 90 pounds; controlled entirely by the boiler pressure, and burning either gasoline or kerosene.

Will sell either separately, or the engine, boiler and burner, piped complete ready for service; and thoroughly tested before leaving the works. Costs one cent per mile to operate.

Photos and prices to bona-fide buyers only.

GRAHAM EQUIPMENT CO.,
170 Summer Street, Boston, Mass.

Successfully Operated Throughout All Seasons

To the thousands who are interested in the subject, it is comforting to know that the

WINTON MOTOR CARRIAGE

is a safe and profitable investment.

It has been demonstrated a success for all season service, under all conditions, and is years beyond the experimental period.

It is the product of the greatest ingenuity and highest mechanical art.

STRENGTH, DURABILITY, SPEED and BEAUTY

are the cornerstones of a solid foundation upon which the success of "The Winton" has been built.

Write for catalog.

PRICE, $1,000. NO AGENTS.

THE WINTON MOTOR CARRIAGE CO., CLEVELAND, OHIO, U. S. A.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS

VOL. V. NEW YORK, OCTOBER 4, 1899. No. 1.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

Declaration of Independence.

From its inception The Horseless Age has been an independent journal, published in the interest of an embryonic but legitimate industry, and bound to or influenced by no clique, club, corporation or promotion scheme. Its policy is dictated solely by the editor, who, in the varying situations that arise, uses his best judgment for the benefit of the future industry. In the earlier days, when all alike were struggling under a ban commercially and groping in the dark mechanically, universal leniency was the wisest course, but the time has now arrived when a more aggressive attitude is needed, and the mechanical principles involved should be more openly discussed. These principles are as old as the universe, and in their special application to this work are not wholly without precedent to guide us. Promotions and "fakes" which stand in the way of progress will be freely criticised. For the earnest but misguided who are working on wrong lines, facts will be presented to lead them to closer inquiry. To the painstaking and the studious who are pursuing the truth; to any who sincerely differ from the editor or feel aggrieved at his utterances, the columns are open.

The editor welcomes light on all questions at issue from whatever source, and will spread it freely for the common good. Cultivating a new mechanical field, he seeks the confidence and approval of his subscribers in his efforts to winnow the chaff from the wheat, nurture the promising germs, and assist to the extent of his power, in the speedy production of a strong and flourishing industry.

Three-Wheelers.

A valued subscriber dissents from our editorial on three-wheelers. If the three-wheeler has a tendency to slip when shod with rubber tires, he adds, then let us discard the rubber tires and return again to the iron tires of our fathers.

Whether a road vehicle should have three or four wheels is a question that ought not to be difficult of settlement on grounds of theory as well as precedent. Our critic scouts custom, apparently regarding it as invariably error confirmed and approved. For this view of custom there is some palliation, but while custom covers many errors, it also proves many theories, for custom with all its blindness is the conserved wisdom of the ages. First, then, as to precedent. Why is the four-wheeled form adopted for horse vehicles? Three-wheeled vehicles have been tried these hundred years and more. Two-wheeled gigs also were formerly much used, and are even now in considerable demand, but the four-wheeled construction has survived them both, and has come to be almost universally adopted. Inasmuch as the two and three wheelers are cheaper to build, there can be but one satisfactory reason for this

preference—the four wheels furnish a more stable base for a road vehicle. The two-wheeler, particularly, gives the rider a disagreeable jolting because it is in close sympathy with the movements of the animal, as well as more sensitive to the shocks of the road.

If the experience of over a hundred years has established the superiority of the four-wheeled form for horse vehicles there is certainly still greater reason for adhering to the same form in motor vehicles. The motor vehicle is more unstable than the horse vehicle. The horse being rigidly attached to the vehicle and moving straight forward, pulling the vehicle with him, exerts some steadying influence upon the vehicle, at least with respect to some of the lateral strains. When the animal is removed, therefore, the road strains have freer play, and the necessity of four wheels is greater than before.

Mr. Bramwell's suggestion that it is the rubber tires of the three-wheeler that cause the single wheel to skid, and that iron tires should be substituted for the rubber, seems to afford a clinching argument for the four-wheeler. To gain a point does he not lose his whole case? How about horse vehicles before rubber tires were discovered? As regards tires, all types were then on an equal footing, yet the three-wheeler did not survive. But a motor carriage without rubber tires is not only more uncomfortable than a horse carriage, but is absolutely impractical on American roads. The wear and tear of both machinery and vehicle would destroy its usefulness. Pleasure carriages travel at relatively high speeds, and the shocks of the road are necessarily increased, although the loads are light.

In our last issue a correspondent stated that "when considered in the abstract, there may be no good reason why four wheels are better than three or five." We have endeavored to show why four wheels are better than three, and it seems to us that there is a very good reason why four are better than five—the same reason, in fact, why a cow has but one tail. Another would be altogether superfluous.

The Other Side of the Electric Racing Machine.

Our Paris correspondent calls attention to the tours de force which wealthy sportsmen have recently made with electric carriages in France, and deplores the one-sided accounts of such performances which the public are compelled to read in the daily and sporting press. Of the condition of a storage battery after a run of 60 or 70 miles at a rapid discharge rate nothing is said. The uninitiated reader is allowed to infer that long runs are quite normal and can be repeated indefinitely with the same battery through recent "improvements" in the storage cell.

As a matter of fact, these foolish feats which are bruited over the world as substantial signs of progress in automobolism are merely evidences of the pitch of madness to which the racing fever has brought the gentry of France. Any competent storage battery expert will agree to design cells capable of such service if he can find clients extravagant enough to want them, but they will soon go to pieces under the strain; one performance, in fact, being sometimes sufficient to cause disintegration.

M. Jenatzy, who now holds the flying start kilometer record in France, announces that if anybody surpasses him he will build an electric machine that will make 125 miles an hour. Possibly this might be done on a suitable track, though at heavy expense, and at the imminent risk of the racer's life. This risk would in some degree be compensated for, however, if M. Jenatzy would give to the public the exact figures showing the cost of the exploit. The public would at least be undeceived, and the pastime of burning up storage batteries would be seen to be hardly a popular sport.

Complicates the Motor to Simplify Transmission.

One of the most interesting carriages that has recently come out in France is the new Vallee, described in this issue. Its chief point of interest lies in the fact that the builder has endeavored to simplify his transmission by complicating his motor. Four-cylinder motors have hitherto been found less desirable for carriages than one or two cylinder, for the reason that the advantages gained in the lessening of noise and vibration were more than counterbalanced by the increase in the number of moving parts which are liable to get out of order. In the new Vallee, however, a great range of power is secured from the four cylinders, rendering a single taut belt of extra width available for transmission. Many of the objections to belt transmission have thus been overcome.

Whether this arrangement will prove as good or better than the two-cylinder motor with gear transmission can only be determined by actual use, but the idea certainly has novel features.

Where Will It End?

Motor racing will soon be run into the ground in France. Already the reaction is manifest. Manufacturers are growing weary of the demands made upon them by devotees of the sport, while the public are impatient at the delay in satisfying their reasonable and profitable demands. Thinking Frenchmen may well ask themselves where the frenzy will end, when an aspirant for honors of the course orders a 52-h.p. racing machine and the holder of the flying kilometer record rashly boasts of his intention to build a machine to run at a speed of 125 miles an hour.

The plain meaning of this situation is simply this: While the French manufacturers are diverting their attention to the construction of freaks and fancies and neglecting to supply even their own home market with practical machines for daily use, foreign manufacturers of a more practical turn of mind are preparing to fill this want, and to them the trade of a waiting world will chiefly fall.

French manufacturers are frittering away their opportunities.

Another Outlet for Electric Cabs.

The electric cab promoters of New York, after trying in vain to grab exclusive cab franchises in the United States and Cuba, have at last managed to pick one up in a rather remote quarter of the globe. Press dispatches announce the acquisition by this star promotion syndicate of the exclusive franchise to operate electric cabs in the City of Mexico.

When it is recollected that these multi-million promoters have less than 50 cabs in service in New York, although hundreds were promised by this time, and that storage battery cabs are demonstrably unprofitable, the value of this lonely and remote franchise may readily be understood.

Why, in an industry offering such splendid promise for solid, well-directed efforts, will men of means and foresight give aid and comfort to unprofitable enterprises? A piteous sound is heard. Methinks it is the bleating of a lamb.

A subscriber of The Horseless Age who wishes to take his motor carriage with him on a European trip would like information on the customs laws of the Continental countries affecting the entry of motor carriages for private use.

The difference in the cost of stabling a motor carriage and a horse and carriage was shown during the recent autumnal tour of the Automobile Club of Great Britain. The excursionists found stable accommodations for their rigs over night at the rate of 30 cents apiece.

Elihu Thomson Favors Steam.

In a lecture recently delivered at Swampscott, Mass., Prof. Elihu Thomson, of the General Electric Co., Lynn, Mass., expressed an opinion that steam is the power best adapted to motor vehicles. The storage battery he spoke of as "an unmitigated nuisance" in this connection. The cost of electricity he put at 25 cents a mile. Steam, however, had its limitations; it needed water every 30 miles and fuel every 40 miles; the boiler might explode and act like a bombshell. Gasoline, so largely used in France, was also dangerous, used under severe restrictions, and should the demand increase it would be very expensive, as the demand already had increased the total production 3 per cent., and the price had doubled in the past three years. Shell boilers, he said, were dangerous.

A boiler could be made which would not explode and could be run by water and kerosene oil. He was running a boiler made out of a coil of pipe, and run it red hot without injury. Kerosene was a fuel found everywhere, while gasoline was scarce; and assuming that certain disadvantages were overcome in applying this fuel, he believed that this would prove the cheapest and most practicable. It burnt the oil cleanly, without leaving any unpleasant odor; 1 lb. of oil, or a pint and one-fourth, furnished in an engine 1 h.p. hour. For 15 miles the cost would be but three cents. This economy in power would enable the man with but little money to spare to get about at moderate expense. Compressed air power had the same disadvantages as a storage battery, he said, others thrown in. Heavy steel cylinders which could not be lightened without danger of bursting, would wear as hard on the tires, make necessary as heavy a vehicle as a storage battery. It was a serious question also whether people should be allowed to carry around cylinders of compressed air at a pressure of 2,500 lbs. to the square inch.

Much was said about liquid air power. He thought it had taken a place in the literature of the day which was not deserved. Some very striking experiments had been made with liquid air, and some persons, perhaps unintentionally, had given out very sensational ideas regarding it. With a pressure of 12,000 lbs. to the square inch when liquid, and expanding entirely without offense, easy to apply, it would be the ideal power, but the expense put it entirely out of the question. He was perfectly certain that at the present time and for years to come, it would not be used for automobiles, and he was not prepared to say that it ever would be.

Woods Motor Vehicle Co. Comes Strongly to the Front.

The Woods Motor Vehicle Co., recently incorporated in New Jersey with $10,000,000 capital to take over and extend the business of the Fischer Equipment Co., of Chicago, has the following strong directorate: John W. Mackay, president Commercial Cable Co.; August Belmont, Dr. W. Seward Webb, president Wagner Palace Car Co.; Charles Miller, Standard Oil Co.; George A. Cox, president Canadian Bank of Commerce; J. Wesley Allison, United States representative Canadian Government Railway System; W. D. Matthews, director Canadian Pacific Railway; H. P. Dwight, president Great Northwestern Telegraph Co.; A. E. Ames, vice-president Imperial Life Insurance Co.; J. W. Lavelle, president National Trust Co., Toronto; Frederic Nicholls, president Canadian Northern Railway and vice-president Canadian General Electric Co.; H. A. Ware, vice-president Northwestern National Bank; C. E. Woods, general manager Woods Motor Vehicle Co.; Benjamin V. Becker, of Newman, Northrop, Levinson & Becker, and Sir William C. Van Horne, chairman Board of Directors Canadian Pacific Railway system.

Frederic Nicholls is president of the new corporation; J. Wesley Allison and A. E. Ames, vice-presidents; A. E. Chandler, secretary, and G. H. Atkin, of Chicago, treasurer.

Factories will be established in Chicago, New York and in Canada.

Progress in Paris.

(From Our Special Correspondent.)

Paris, Sept. 18.

AUTOMOBILE RACES.

Races in France are on the increase. The contestants scarcely have time between heats to make the necessary repairs to their vehicles. The "Tour de France," the longest route so far covered, has been quickly followed by the Paris-St. Malo, Paris-Trouville, Paris-Boulogne and Paris-Ostend contests. A noteworthy feature of the Paris-Ostend race was the participation of an electric carriage on the B. G. S. system, which made the distance of 195 miles with only two recharges. It was a dogcart carrying two persons, and weighing about 2,200 lbs., one-third of which was accumulators. There is no means of knowing the state of the battery at each recharge and the voltage at the end of the journey. It would also be very interesting to learn the durability of a battery constructed for such service, i. e., how many days it would last when overtaxed in this way. Your correspondent is not sanguine of the future of the electric racing machine; the batteries are too heavy and of too little capacity. As to the economic side of the question, we pass that over in silence, the results being generally disastrous. We believe the public should be informed on the subject of electric locomotion. The results laid before it from races and tours de force are wholly incomplete. For example, in the case cited above the bare announcement is made that an electric carriage made a run of 60 to 70 miles on one charge, and the innocent reader immediately infers that this performance could be repeated indefinitely with the same battery. Nothing could be further from the truth. The capacity of the battery rapidly falls in such overwork, and soon a distance of one-third of the above would be all that could be accomplished. Average performances should be mentioned, and not the extraordinary only.

Races, which were at one time useful in this country, in that they impressed the imagination of the public and illustrated forcibly the advantages of this method of locomotion, are losing interest every day because of their frequency. Practical points in connection with the movement are cast into the shade. The cost per kilometer and wear and tear are entirely forgotten. Manufacturers are wholly occupied in building "freak" machines for enthusiasts of the track, while the needs of the great body of users who wish a reliable vehicle for constant use are unsatisfied.

MOTOR CONTEST OF LA LOCOMOTION AUTOMOBILE.

The competition which La Locomotion Automobile has organized to determine by average tests the actual horse-power developed by vehicle motors, is likely to prove a great success; entries are being rapidly made, and the public will have an opportunity of learning from it whether motors sold to them as 4, 6 or 8 h.p. really develop these rated powers.

IMPROVED GAILLARDET MOTORS.

The Société Bourguignonne d'Automobiles à Dijon has just completed a small voiturette, propelled by a Gaillardet motor without a water jacket. In order to secure a perfect cooling they have endeavored to carry away the surplus heat through the ribs by means of a spray of water and air. Experience has proved that this innovation gives good results.

HEAVY WEIGHT COMPETITION.

From the 5th to the 11th of October the Heavy Weight Competition will take place at Versailles. The contest will consist of a six-days' service amounting to about 210 miles. Each vehicle must be able to make at least 10 miles without renewing supplies. The entries up to the present time number 10, and are identical with those of last year. It is to be hoped this competition will advance the cause of heavy motor vehicles, for at the present time there are no heavy motor vehicles in regular practical service.

PROMOTION OF ELECTRIC VEHICLES IN PARIS.

The electric vehicles of the Compagnie Générale, which were numbered, stationed upon the public streets and provided with the ordinary fare bulletins, have never been fiacres in anything more than appearance, for every person who has ridden in one has been obliged to pay a fare two or three times the bulletin rates. In suppressing the numbers on the lamps and doing away with the bulletins, therefore the Compagnie Générale has not done away with the "fiacres," as was recently reported in your journal. They really never were "fiacres."

In addition to the above named company, there is the Société l'Electrique, founded specially for the purpose of developing the electric vehicle, whose red vehicles are distinguishable by their elegant appearance and good performance.

The only real "fiacre" or public electric cab in Paris at the present moment is No. 16060, of the Jeantaud type. Unless the problem is decidedly modified it is likely to remain the only one for some time to come.

AUTOMOBILISM BEFORE THE LEARNED SOCIETIES.

The meeting of the French Society for the Advancement of the Sciences, which takes place on Sept. 18 at Boulogne-sur-Mer, will be signalized by a discussion of the automobile, the first time the new locomotion has come before so august a scientific body in an official way. MM. Mesnayer and Cuenot, Engineers of Bridges and Roads, have prepared a paper on automobolism from the threefold view of the motor, the vehicle and its use, which will be read before the assemblage. The paper will be divided into three parts—history, the mechanism, the future of the motor vehicle and reforms to be hoped for.

PARIS—ST. PETERSBURG.

The Paris-St. Petersburg race, which has been on the tapis for about a year, seems more improbable now than ever. An emissary of the Automobile Club who was sent out to investigate the roads over the proposed route, reports that while the roads are very good through Germany, they are so hopelessly bad in Russia that the strongest machine would be wrecked, and often miles from succor.

THE HENRIOD MOTOR.

One of the most interesting motors now before the public on this side of the water is the Henriod, which uses either gasoline or alcohol as fuel, has no jacket and is provided with a distributer instead of a carbureter. The motor shown in Fig. 1 is of the balanced two-cylinder type, making as high as 1,000 revolutions per minute. A ball governor, mounted direct on the motor shaft (see Fig. 2), actuates by centrifugal force a grooved sleeve D, in which works a disk i, mounted on another sleeve D', movable along the shaft a. A pinion O',

mounted on the shaft of the motor, gears with a pinion O, having a double number of teeth, and thus transmits the motion of the shaft at half speed. On D is the disk i, carrying a cam, forming an eccentric, which under normal conditions is placed opposite the rods S, working the exhaust valves.

When the speed of the motor is increased, the governor causes the sleeve D to occupy a position such that the cam assumes a circular form, and the stems of the valves pressing against it are in the proper position for exhaust. Hence on the suction stroke, the inlet valves from the distributer remain closed, and no explosive charge entering, the motor shows down at once. The governor is controlled by a spring adjusted to any desired tension by means of a handle.

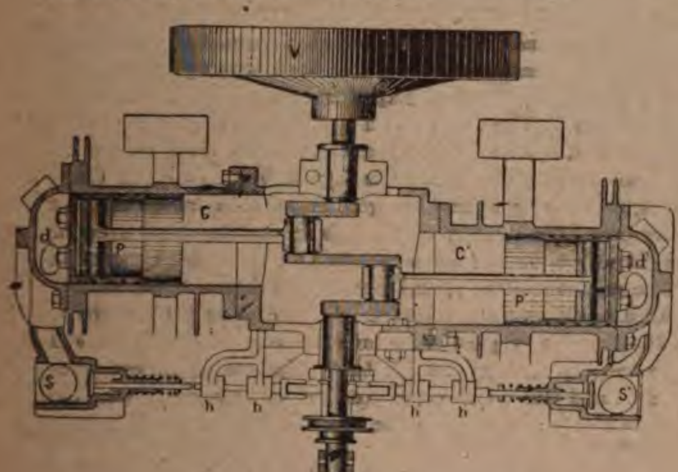


FIG. 1. PLAN OF HENRIOD MOTOR.

The distributer is composed of a cylinder C, with two valves, A and B (see Fig. 4), one above the other. The lower valve, A, whose stem passes through the entire distributer, is raised by the suction of the intake of the motor. The upper end a carries a screw engaging with the screwed plate E, in which is a screw V, controlling at its lower end through a sleeve and springs the valve B.

The distance between the valves A and B can thus be adjusted by screwing the spindles V and E up or down, allowing the valve A a larger or smaller lift before acting on the valve B. The two coil springs R and r hold the valves A and B to their seats.

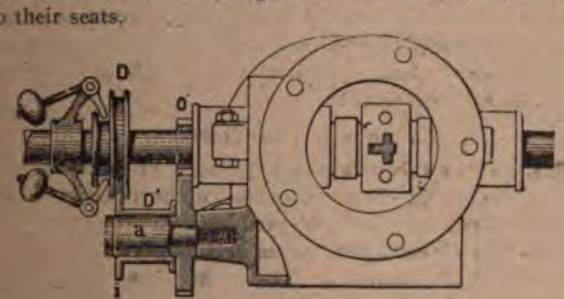


FIG. 2. GOVERNING DEVICE.

The guide sleeve of the valve B has a circular chamber M, in direct communication with the supply of fuel through an opening O. The moment the valve B rises the oil passes from the chamber M, through O O, and spreads over the top of the valve B, provided with circular channels to hold the oil. The chamber N, is pierced with orifices d d, through which the outer air is sucked under the influence of the vacuum produced in the apparatus by the motor itself across the two valves A and B, when lifted from their seats. This air is carbureted by passing through the circular channels, which retain the oil above the valve B. The air then passes into the cavity F, which is also provided with a circular channel f, retaining the surplus oil from the valve B. Through the orifices d' d', arranged around the chamber F, the outer air mixes with the air which has just been carbureted in f. The explosive mixture thus formed then passes into the cylinder.

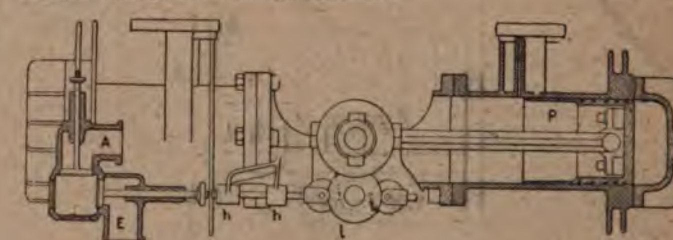


FIG. 3. VALVE GEAR.

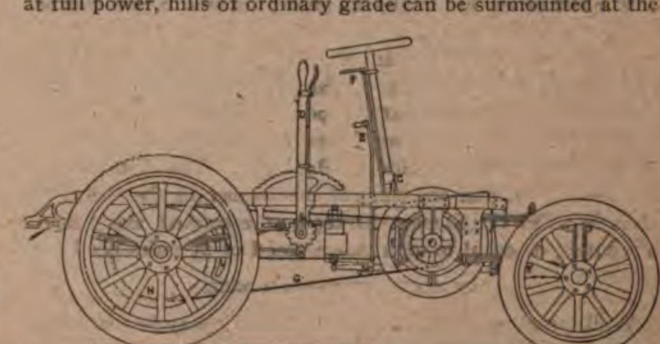
The orifices d d and d' d' are covered by rings N' and F'', the rotation of which opens the corresponding air orifices, so that the admission of oil is in constant volume, and does not depend on temperature as in ordinary carbureters.

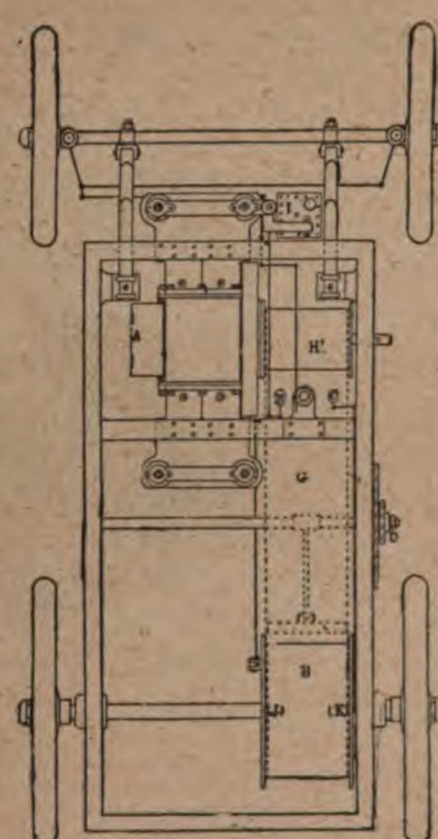
Before being admitted to the distributer the air is warmed in a box, through which the exhaust passes, each charge of explosive mixture consisting of three parts: (1) The air flowing from the upper chamber (N) of the apparatus; (2) the oil forced into the chamber, and (3) the air admitted directly into the lower chamber F. Only at the moment when the desired compression is produced in the cylinder does the mixture become ripe, in consequence of which the cylinders do not heat up as they ordinarily do, and motors of 10 h.p., it is claimed, may be run successfully without a water jacket.

In one of the recent races in France a Henriod carriage made the entire distance of several hundred miles without other cooling devices than radial ribs.

VALLEE FOUR-CYLINDER MOTOR.

M. Vallee, the well-known builder, of 19 Rue des Arts, Levallois-Perret, has put out a new vehicle, propelled by a four-cylinder motor, communicating power to the rear wheels by means of a wide belt. The speed changes are obtained through the variations in the speed of the motor. A pedal closes the exhaust, when the motor acts as a brake and the carriage slows down at once. The addition of two more cylinders is claimed to render complicated transmission mechanism unnecessary, and with all four cylinders working at full power, hills of ordinary grade can be surmounted at the





rate of 18 miles an hour, the motor then giving two explosions each revolution. The motor will work at as low a speed as 50 turns to the minute. B is a pedal, I the carbureter, F the mixture valve, H is the drum, J the reversing mechanism, K the differential, C the brake, D the belt-tightening lever. So wide is the belt and so taut that it does not stretch even on the steepest hills, and furthermore it is said to be absolutely impervious to moisture. Two mechanical brakes are provided, one acting inside the drum and the other a shoe brake, manipulated by the lever D, acting on the outside of the drum H.

LONDON NOTES.

THE STANLEY STEAM CARRIAGE IN FRANCE.

London, Sept. 21.

It is not often that I refer to racing matters in this column, but I do so this week, owing to the fact that in the Paris-Boulogne race, which was run off on Sunday last, there figured two Stanley steam carriages. While they were generally admired at the starting points, something must have gone wrong with them en route, for neither of the riders figured in the classification at Boulogne. The distance was 230 kilometers, and the time of the winner in the voiturette class, in which the Stanley carriages were entered, was 7 hours 9 minutes, or equal to an average speed of 25 miles per hour.

AN ACCIDENT AND A MORAL.

While speaking of the Stanley carriage, it may be mentioned that one of this type took part in the Automobile Club's tour to Folkestone this week. It was driven by Mr. Searles, of the Locomobile Co., who, I regret to say, met with a nasty accident. It appears that on going down a hill the band brake failed. Mr. Searles promptly reversed the engine, but unfortunately one of the glands blew out. As the carriage was rapidly gaining speed, the driver had no alternative but to run into the side of the road, with the result that the vehicle was turned over, the wheels being buckled and the frame twisted. Both Mr. Searles and his companion were thrown out, but escaped with slight injuries. If there is any moral to the accident, it is that the carriage should be provided with an additional brake, as band brakes are unfortunately apt to fire or otherwise go wrong when descending steep hills.

MR. THORNYCROFT'S PAPER.

One of the most interesting papers presented to the British Association meeting at Dover this week was that by John I. Thornycroft on "Recent Experiences with Steam on Common Roads." The paper was a résumé of the author's labors in steam road vehicles, which are now being made on a commercial scale by the Steam Carriage & Wagon Co., of Cheswick, they having secured the gold medal at the recent trials at Liverpool. Mr. Thornycroft, who is known the world over for his torpedo boats and water tube boilers, concluded by stating: "The problem of the light locomotive I believe to be already solved in all its main features. A more extended experience will, of course, suggest many improvements in details. It will be necessary to carry heavier loads than are at present practicable, and this will become possible simultaneously with the removal or amendment of the existing restrictions as to tare weights."

In connection with the meeting of the British Association at Dover this week, a motor vehicle exhibition was held there on Tuesday and Wednesday. It cannot be said to have been a very attractive one, as there were only about eighteen exhibitors. The largest display was of steam wagons.

PUBLIC MOTOR SERVICES.

Very few people recognize the enormous progress which is being made with motor vehicles in the United Kingdom. The number of carriages used by private owners is, of course, growing as fast as makers can turn them out, but it is in the direction of public services that the progress is most marked. An indication of this is to be found in the list which has just been issued by one motor manufacturing company in Coventry, which shows that motor charabancs and wagonettes of their construction are plying for hire as public vehicles in no less than thirty-seven different towns. And this is only what one firm of builders has done!

MORE NEW CARRIAGES.

Almost every other day particulars reach me of new experimental carriages being in course of construction. I have just been furnished with brief particulars of a new two-seated carriage which is being constructed in Southport, Lancashire, at the works of Mr. Oliverson. The motive power will be a gasoline motor having electric ignition and a water jacket. There are, I understand, several new features in the carriage, which will weigh 700 lbs., chief among which is the variable speed gear, which has been devised and patented by Mr. Oliverson. Another new carriage is that which has just been completed by the Anglo-American Motor Car Mfg. Co., of Halifax, Yorkshire. The motive power is supplied by a double-cylinder gasoline engine. One of the characteristics of the carriage is the free use that has been made of aluminum, this metal having

been used for the steering column, steering hand wheel, crank chamber and silencer. Another feature of the simplicity of the mechanism is the three speeds, and the reversing motion being controlled by a single lever. The Anglo-American Co. is at present in the turmoil of removing its works from Halifax to York, and is withholding full particulars until settled down in its new quarters.

ENGLISH MOTOR FIRE ENGINES.

The fact that self-propelled fire engines have not yet found favor in London does not necessarily illustrate any lack of ability on the part of British manufacturers of fire engines, and it is interesting to learn that Merryweather & Sons, of Greenwich, London, have just constructed such an engine for use in India. Outwardly, the vehicle resembles in general appearance an ordinary English fire engine; it is, however, fitted with an arrangement of spur gearing which enables the engine to drive an intermediate shaft when put out of gear with the fire pumps. The intermediate shaft is fitted with a differential or balance gear and drives the rear wheels by means of sprocket wheels and chains. Steering is effected by a hand wheel. The pumps are capable of delivering 300 gals. of water per minute, and of throwing a jet to a height of 150 ft. When the fire engine was tested in London, no difficulty was found in mounting hills at a speed of 10 miles per hour, while on comparatively level roads a speed of 15 to 20 miles per hour was easily maintained. The steering wheel, steam regulating lever, reversing lever and brake are all within easy reach of a man sitting on the off-side of the front, and an auxiliary brake is provided to work at the back. The machine is arranged to carry the usual complement of firemen, hose and gear, and the entire weight, when fully equipped with fuel, water and the firemen, is under three tons. The boiler is of the same pattern as that used in the construction of the engines supplied by this firm to the Metropolitan Fire Brigade. Steam can be raised from cold water to working pressure in six minutes; but if a heater with self-locking couplings and automatic disconnection is fitted in the engine house, steam can, it is stated, be raised in so short a time that the engine can start at full speed from the fire station in from three to four minutes from the time of receiving the alarm. When the scene of action has been reached, the fire pumps can be at once thrown into play.

ENGLISH LIGHT STEAM CARRIAGES.

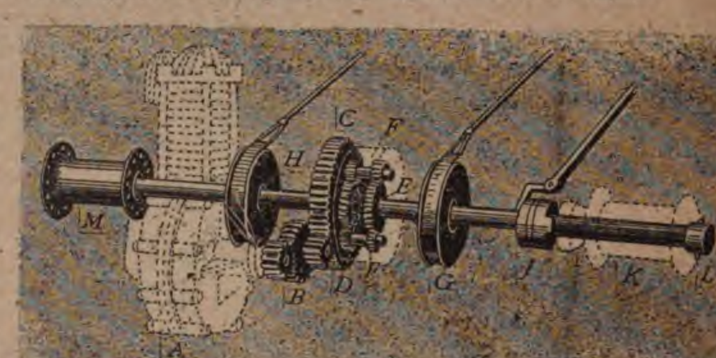
In the heavier class of steam vehicles, the recent trials at Liverpool go to prove that very great progress has been made. For a long time little or nothing has been done in England in the way of the construction of light steam vehicles. Since the advent of the Whitney carriage in July last, followed in August by the Stanley, it is astonishing what attention has been attracted to light steam vehicles over here, and it is said that several English steam carriages to carry two or four persons will shortly see the light. Among the concerns engaged on the designing of such vehicles is the Liquid Fuel & Engineering Co., whose heavy wagons and omnibuses have already got well beyond the experimental stage.

A NEW LIGHT FRENCH VOITURETTE.

For some time past the prevailing feature of the automobile industry in France has been the great number of light voiturettes to seat two or three persons which have made their appearance on the market. The accompanying illustration shows the Hugot carriage made by M. Hugot, of 8 Rue Sainte Apoline, Paris, in which the motive power is supplied by a 2¼-h.p. De Dion gasoline motor, or an Aster motor of similar power (the latter described in a recent issue of The Horseless Age), the ignition in both cases being electric, and the cooling of the cylinders by means of radial fins, while the carbureter employed is that known as the Longuemare. A two-speed gear is provided by means of which, assisted by the variations possible in the ignition and carburetion, speeds ranging up to 18 miles an hour on the level and 8 miles up hill can, it is claimed, be attained. As will be seen from the illustrations, the motor is situated on the rear portion of the frame and drives the wheels represented by K and M through the intermediary of the small pinion B and the balance gear, consisting of pinions F, E, D, C. At J is an ordinary step clutch,

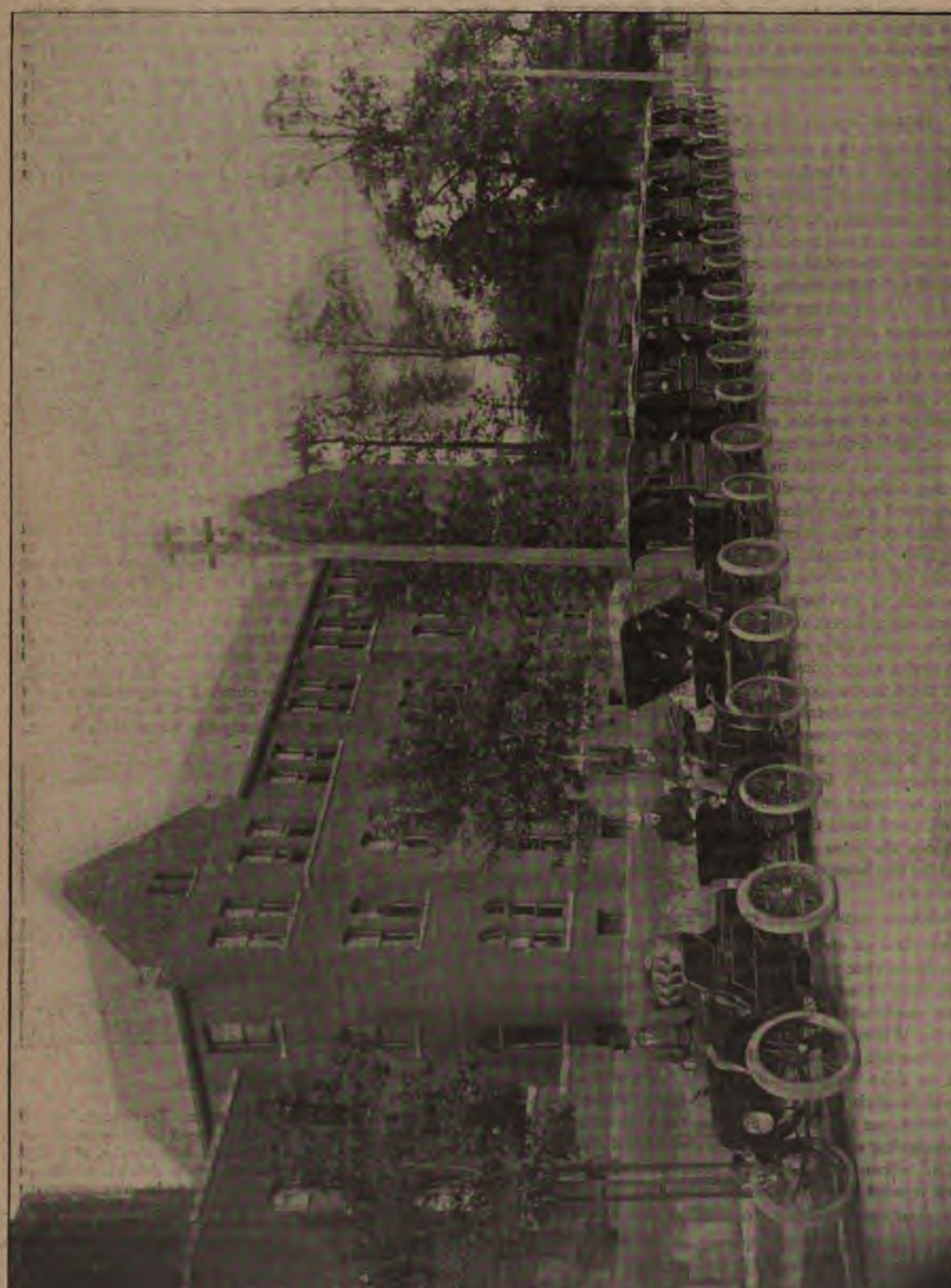
HUGOT CARRIAGE.

by means of which the wheel K can be made rigidly connected with the right half of the axle, or to run free on the same, when the low speed is in gear, i. e., the normal position of the transmission device. The wheel K is rigidly connected with its part of the axle, and the power of the motor is transmitted through the differential gear to both of the wheels. The gear case which surrounds the balance gear also serves as a drum for the low speed brake (not shown in Fig. 2). When it is desired to change over from the low to the high speed, the band brake G is tightened, the clutch J being at the same time released, allowing the wheel K to run loose on its part of the axle, the result being that only the wheel M is driven, the



HUGOT TRANSMISSION.

speed being double that of the low gear. To change back from the high to the low speed the high speed band brake H is applied and the clutch J again brought into action, although at the high speed only one of the wheels is driven, which seems to us a drawback. The carriage is said to be very successful in Paris. The body is suspended on a steel frame by plate springs at the front and C springs at the rear. The little carriage has accommodation for three persons, two facing the direction of progress and one on a seat contrived at the front on the box containing the tools, battery, etc. The wheels are of the cycle type, shod with pneumatic tires, while the weight of the rig complete is given as about 440 lbs. It can, it is claimed, mount gradients of 1 in 10. Arrangements are provided for starting and stopping the motor from the driver's seat.



AN IMPOSING ARRAY OF WINTON GASOLINE VEHICLES.

THE NEW WINTON RACING MACHINE.

Winton Racing Carriage.

We print herewith a photo of the new racing machine just completed by Alexander Winton, of the Winton Motor Carriage Co., Cleveland, O. It is of the same general design as the smaller carriages, but stronger, heavier and much higher powered.

We also add another photo, showing an array of Winton carriages lined up in front of the factory. The procession is headed by the racer, after which come the standard phaeton and a lot of seven advertising wagons made for Dr. R. V. Pierce, the well-known medical specialist, of Buffalo, N. Y.

The Winton Co. have almost doubled their floor space, and expect to be equipped to turn out delivery wagons and phaetons in greatly increased numbers during the fall and winter.

The Fairmount Park Commissioners, Philadelphia, Pa., have so far relented that they are making test runs with motor carriages to ascertain the effect on horses in the park. A resolution requesting the admission of motor vehicles to the park was recently introduced in the Council.

W. L. Elliott's Latest Model.

The Elliott Motor Carriage Co., Oakland, Cal., are exhibiting their latest model at the Mechanics' Fair, San Francisco. It is propelled by a 4-h.p., double-cylinder gasoline engine, employing electric ignition.

The weight of the vehicle is 1,200 lbs., and the driver sits on the left.

Automobile Company of America's New Styles.

The Automobile Co. of America have just finished two new styles of vehicles propelled by the "American" gasoline motors; a stanhope phaeton and a brake, and have a touring brake and a delivery wagon well under way.

The stanhope is so constructed that if the top is taken off a second seat may be opened up in the rear, thus accommodating five persons. Power is supplied by a 7 h.p. twin motor, balanced and muffled. The weight of the vehicle is 1,400 lbs., the extreme mileage on one supply of fuel is 150, and the maximum speed is 28 miles an hour. The capacity of the water tank is 8 gals.

The brake accommodates six persons, runs 250 miles on one supply of fuel and weighs 1,600 lbs.

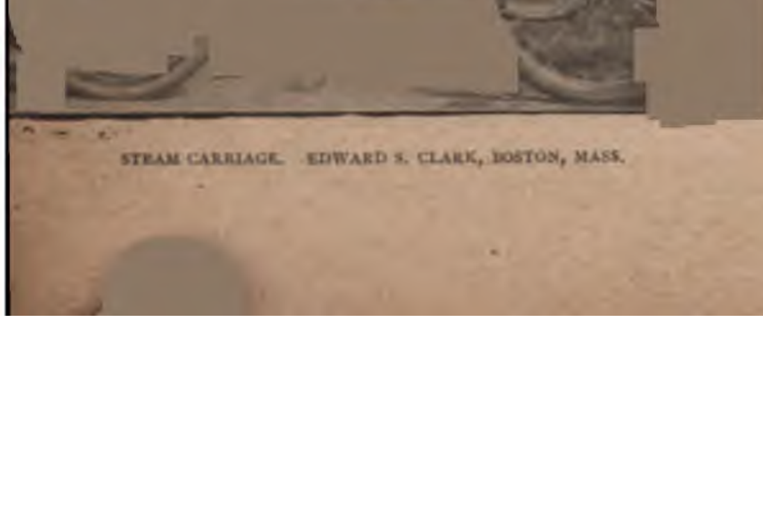
The touring brake, the design of which is reproduced here, will carry enough gasoline for a run of 450 miles. The 8 h.p. motor is vertical and is placed in front of the vehicle, leaving the whole of the body free for passengers and luggage. There are three forward and three reverse speeds, and an emergency brake on the wheel in addition to the ordinary band brake. Solid tires and wooden wheels are preferred for this class of vehicle, although an option is given the purchaser with respect to tires and wheels.

The delivery wagon has exactly the same gear as the brake and is intended specially for country use. It was designed for B. Altman & Co., the well-known New York dry goods merchants, who have placed an order with this company for a number of them.

The Clark Steam Carriage.

Edward S. Clark, builder of marine engines and boilers, 272 Freeport St., Boston, Mass., is the designer and constructor of the steam carriage herewith shown, which has been in use for several months by the inventor, and has shown itself well adapted for road use.

In style it is a dos-a-dos, and its weight is 1,200 lbs., all supplies on. Wire wheels, 30 and 34 in. respectively, with hubs 5½ in. wide and ¼-in. spokes, swaged down to 3-16, are employed. The pneumatic tires are 3 in. in diameter. The frame is of steel tubing; the front axle is tubular and the rear solid. Full allowance is made in the front of the frame for the inequalities of the road. Roller bearings are used in the rear axle.



STEAM CARRIAGE. EDWARD S. CLARK, BOSTON, MASS.

All the machinery is incased in the body, the compensating gear, brake and driving gear being all inclosed together in a dust-proof case on the hind axle.

There are two handles, one for steering, the other for reversing and regulating speed. The latter works straight up and down, and the former may be turned over and used on either side of the seat.

A band brake is operated by a pedal. The boiler is Clark's patent water tube boiler, so constructed that no explosion can take place, and there are no large surfaces to burn out. If the carriage is left standing for half an hour and the water gives out, no damage will be done.

The safety valve is set at 300 lbs., and the diaphragm closes the fire down at 250 lbs.

The double cylinder, reversible engines develop 6 h.p., a special reversing device being employed. A burner of improved design, on which patents have been applied for, is said to be free from the objections heretofore found in burners of this class.

The supplies consist of 5 gals. of gasoline and 20 gals. of water, and the seating capacity is five or six persons, if desired.

THE SHAW DRIVING AND STEERING SYSTEM.

In Mr. Clark's shop is a veritable curio in the way of a motor carriage, which is being built for a Hyde Park inventor named Shaw, a locomotive inventor of some note. The miniature steam engine that is to run it is practically all under instead of behind the seat, so that the vehicle is smaller and of somewhat neater design than most others of the runabout class. But the distinctive feature of it is that in driving and in steering both front and rear wheels act together.

For the driving a duplex arrangement of sprockets and chains exerts power on the front and rear axle at the same time. This arrangement is expected to be of great assistance where one pair of wheels happens to get stuck in a depression, or runs up against an obstruction.

In the steering the contrivance shows the most ingenuity. A long lever, rising perpendicularly outside the body of the vehicle at the left, is connected beneath the carriage in such a way that when the lever is pushed forward the axles pivot in unison. That is, in case of a turn toward the left, the push on the lever brings the forward and rear wheels on the left hand side of the vehicle toward each other, spreads apart the forward and rear wheels on the other side, and makes the rear wheels assist in the work of changing the direction of the carriage. A push on the lever in the other direction produces the turn to the right. It is expected that this arrangement will allow some surprisingly short turns to be made.

The pacing machine branch of the motor business is receiving a good deal of attention near Boston. The Waltham Mfg. Co. are going into that line of business quite extensively, and a steam motor pacing machine is under construction at the Newton works of the Locomobile Co. of America. The motor, placed between the front and rear seats, will be operated by the second rider, while the first looks after the steering of the machine.

GASOLINE TOURING BRAKE. AUTOMOBILE CO. OF AMERICA, NEW YORK.

LARGE GASOLINE STANHOPE PHAETON. AUTOMOBILE CO. OF AMERICA, NEW YORK.

COMMUNICATIONS.

Need of a Standard of Efficiency.

Springfield, O., Sept. 20.

Editor Horseless Age:

Having been a reader of The Horseless Age since the issue of its first number, I would like to call attention through the columns of your paper to the necessity of the early establishment of a standard of efficiency, by which the performance of all gasoline automobiles can be measured.

The time is not far off when cost of operation will decide the question as to the kind and make of vehicle which is to have the preference.

Of course other things besides the cost of operation are to be considered, but improvements in all kinds of automobiles are being so rapidly made, that what at first seemed objectionable or impractical features in each are fast yielding to the efforts of the countless inventors now working in this line.

At present there are numerous makes of automobiles being offered for sale, and it would surely be a benefit to all intending purchasers if some rule were established whereby the performance of the automobile could be measured.

We read in the different advertisements the cost of operation, which is variously stated to be a small fraction of a cent per mile.

Now, one manufacturer might mean the average cost on the average road in his locality, while another manufacturer might base the cost on the very best performance he had ever been able to get out of his vehicle under the most favorable circumstances.

From what has been published in different ways, the public already expects entirely too much from the automobile.

The fairy stories we read about its being possible for one to do business in the city and live 20 miles out, going back and forth on an automobile at a cost of but a few cents a trip, sounds ideal, and no doubt can be realized under the most favorable conditions, but such statements are premature and give the public the idea that such performances can be had from an automobile every day, rain or shine, without any especial thought as to the kind of road to be traveled over.

The near future holds in store for the work-a-day man the possibility of traveling a great distance, rain or shine, over good roads at the cost of but a few cents, and what is needed now is a fixed standard of efficiency by which all vehicles using liquid fuel can be rated.

The price of gasoline not only fluctuates greatly, but is different in different localities, so that it seems to me that the most practical way to establish a standard of efficiency would be to base the calculations on the amount of fuel consumed in traveling a mile on level road at a given speed.

The rule would apply to all vehicles using liquid fuel. A manufacturer in rating his automobile could use a statement something like the following: "Our Model A will carry a load of 350 lbs. at the rate of 10 miles per hour on hard, level road with a consumption of gasoline at the rate of one-half pint per mile."

Or, "Will climb a 20 per cent. grade (hard and smooth) at the rate of 3½ miles per hour, with a consumption of fuel at the rate of 1½ pints per mile."

It matters very little what the horse-power of the engine is or even the weight of the vehicle, so long as the cost of operation and speed are known.

From a rating something on lines as suggested above, the intending purchaser can determine which vehicle will best meet his requirements.

A large factor must always be allowed for the increased power required to travel over the same road when it is wet or soft, if a certain schedule is to be maintained.

The editor of The Horseless Age calls attention frequently to the importance of starting this new industry on a sound and practical basis, and it seems to me very desirable that, as the automobile emerges from the experimental state, the public should be given facts and data regarding its performance so that an intending user can select with safety a vehicle suited to his needs.

Hoping these suggestions will result in good,

I am very respectfully,

R. P. THOMPSON.

Balanced Gas Motors—Thrust and Torque.

New Haven, Conn., Sept. 29.

Editor Horseless Age:

It is a pity that some one does not get up and nail, once for all, the fallacious notion that the explosion in a gas engine cylinder may be "balanced" by a simultaneous explosion in an opposite cylinder, with the pistons moving toward each other. Every few months we hear of some fresh contrivance of this sort, and the fact that none of them are ever heard of after their first appearance seems in no wise to deter succeeding inventors.

As a matter of fact, the pressure of the explosion, acting in a direction parallel to the cylinder bore, is sustained within the engine itself, by the crank shaft bearings. It is never sensible externally, and it no more requires balancing or can profit by it than a cat requires two tails. What really is sensible externally—aside from the inertia of the reciprocating parts if these be unbalanced—is the reaction of the engine frame from the twisting moment applied by the explosion to the shaft. As this reaction is equal to the twisting moment, it follows that when the explosions are made to occur simultaneously instead of singly the engine will shake just twice as much as before, instead of less. The real problem is not one of thrust, but of torque, and the attempt to balance the torque by any of the usual expedients is a good deal like trying to lift one's self by one's boot straps.

The above distinction is frequently not understood by gas engine experimenters, but it would seem to be more than ordinarily nebulous in the communication of Mr. Ernest M. White, in your issue of Sept. 20. The motor illustrated in his Fig. 1, in particular, will not do a single one of the things he claims for it. As the cylinder axes are far out of line, the mechanical balance would be very imperfect even if the reciprocating and rotating parts always moved in opposite directions and at the same speed. But they do not even synchronize, as any one may see by following the arrows. When the lower piston is at the end of its stroke the upper one will be about midway of its return stroke; and, needless to say, the explosions are not simultaneous. It would almost seem as if

the engraver were at fault, and that the upper crank pin was intended to be below the center, like the other. Even thus, however, the arrangement would be much inferior to the conventional opposite cylinder type with two cranks 180 degrees apart on the same shaft.

In the motor shown in Fig. 2 of the same letter, both crank shafts rotate in the same direction, and there is not even the superficial semblance of a balanced torque. It is to be noted that Figs. 1 and 2 are diametrically opposite in principle, so that even if one were correct the other could not be. In point of fact, however, neither arrangement has any good excuse whatever.

HERBERT L. TOWLE.

An Advocate of Three-Wheelers.

Hyde Park, Mass., Sept. 28.

Editor Horseless Age:

I have always admired your open expression of opinion on matters automobile, particularly on "Liquid Air," and you ought to be backed up by all interested in your endeavor to point out what to avoid to the inexperienced and thus save them many dollars and much time.

Once in a while, however, in your discussion of the legitimate problems confronting the horseless carriage designer, you run counter of what my experience teaches, and as you invite discussion I take the liberty to object to your remarks and conclusions regarding a three-wheeled as compared to a four-wheeled vehicle.

You state the three-wheeler skids more than the four-wheeler, and that the public do not want three wheels anyhow.

As to skidding, I would advise the removal of the pneumatic tires, substituting ordinary buggy wheels, that is with iron tires. This done, I think you would not be able to make the three-wheeler skid, however greasy the pave.

As to the public, I should like to ask what do they know about it? Are they ever consulted by a railroad company as to the style of the locomotives they propose to use, or the number of wheels, etc.? I beg to say that if a motor carriage is developed it will be done by some one who is not aware of a public or their supposed ideas, or one who does not care a rap anyway. The public will have to be trained.

I do not think it is good policy in the present state of the art to cast any reflections on designs that are being worked out. The fact that others have abandoned three-wheelers proves nothing at all.

Yours truly,

W. C. BRAMWELL.

Steel Tubing for Piping.

Peoria, Ill., Sept. 26.

Editor Horseless Age:

Some time ago you inquired for parts that might be made by a part supply company for motor vehicle service. It occurs to the writer that all vehicles use more or less piping, and that a light article using steel tubing and malleable iron or steel fittings, so as to be both strong and light, would be quite acceptable to the motor vehicle builder.

At present, gas piping is the only article available, unless something special is turned out by each maker, and when this is done it is hard to get supplies. If some concern would supply steel tubing, either with fine threads or with rolled thread and light steel fittings to match them, they would find buyers all over the country, because of strength and saving in weight.

Not only would motor vehicle people buy such an article, but many other lines of work would be pleased to get light tubing able to resist vibration, because of its rolled thread. It is well known that gas piping is quite irregular inside and out, and that the thread largely destroys its strength.

We offer this suggestion for what it may be worth.

DURYEA MFG. CO.,
By C. E. Duryea.

Air Not a Cushion Under All Circumstances.

Peoria, Ill., Sept. 30.

Editor Horseless Age:

I have read with some interest the article by Mr. Graham in your issue of Aug. 30, also the reply thereto by E. A. U. in your issue of Sept. 20. I am inclined to decide with Mr. Graham under the circumstances, inasmuch as air is not a cushion in all circumstances. I know from experience, if rubber is confined so it cannot expand, as for instance a rubber tire in a steel rim, that portion which is exposed above the rim only acts as cushion, while that portion which is in the concave part is simply dead and will not expand, as it is held in confinement, unless the rim will yield. In my opinion, the rubber pneumatic cushion, as I understand it, is an unyielding receptacle in which air is compressed to a certain measure, according to the weight it carries, which, of course, would be according to the weight of the wagon bed, which, under some circumstances, would be considerable, and which is dead weight and cannot be compared with a bicycle tire, as only a small portion of the tire is compressed in coming in contact with the ground. If the receptacle or cushion itself was made of expansive material, the case would be quite different, as air which is already compressed under the dead weight and cannot yield any more would stretch the bag or cushion, and thereby make it elastic, and no doubt be of some use for which it is intended.

In my opinion, a solid rubber cushion made of the right consistency of rubber would be far better for pneumatic cushions, providing it was so placed so it could expand in all directions, and this could be made in the same shape of a pneumatic cushion which would be most desirable.

Yours truly,

F. H. BOLTE.

A Friend of Truth.

Boston, Mass., Sept. 28.

Editor Horseless Age:

The writer has noticed your editorial concerning the "Liquid Air Fake" in Boston, and wishes to commend you highly upon

the stand you have taken, and the horseless vehicle industries are to be congratulated that there is an editor with nerve and honesty enough in his makeup to speak boldly against the corrupt methods used by "fake" organizations who are using an honest, growing industry for selfish, mercenery methods. These are not the only ones, and we trust you will continue your good work.

With best wishes for the growth of The Horseless Age, I am, Yours very truly,

W. S. ROGERS.

LESSONS of the ROAD

Users of motor vehicles are invited to contribute to this department for the good of the industry.

Incidents of a New England Motor Tour.

New York, Sept. 26.

Editor Horseless Age:

Some of your readers may be interested in comparing their experiences with mine in a recent trip of 350 miles which I made from the White Mountains through the Connecticut Valley to New York with a gasoline phaeton.

As a general rule I found few horses seemed afraid, although I have always used extreme caution, especially if a woman was driving. I think all who have had road experience have noticed that the main difficulty with a horse driver is that his mind is so much absorbed in observing the motor carriage he pays little attention to his beast, and many accidents otherwise avoidable may be attributed to this fact.

The question so often discussed as to whether in meeting a timid horse it is better to push rapidly ahead or slow down or even stop, I think is surrounded by so many conditions that no general rule can be laid down, each case resting in the sound discretion of the motorist.

One driver whom I met on my trip through New Hampshire had a mind of a decidedly practical turn. He was a Hebrew peddler, and was driving a poor, jaded creature, attached to a heavily laden wagon. On seeing the motor carriage approaching, he excitedly raised his hand as a signal to stop, which I did at a distance of probably 300 ft. As the horse showed no signs of fear and the man seemed to be waiting for something, I called for him to come on, when, with a characteristic gesture, he said: "Vell, if I come on, who pays the damage?" The man's eye for business was beautifully illustrated by this incident, but it is needless to say that the question of damage had no chance to arise.

I found numerous instances of horses standing by the roadside without drivers and without fastening, and through this negligence occurred the only accident which happened during the entire run. A large and coltish horse attached to a loaded ice wagon was left unattended in the middle of a street in a Vermont town. I stopped at a reasonable distance, not intending to pass him until his driver should make his appearance, but the horse, after surveying my carriage, preferred not to wait for his driver, and suddenly wheeling around, proceeded to make free deliveries of ice through the village at a very remarkable rate.

I found no difficulty in obtaining supplies of gasoline at the principal towns and villages, though it would be of great assistance to motorists if a list of the stores keeping gasoline were accessible. In Great Britain and France such lists have been made up with great care by the automobile clubs, and, I understand, have proved of much value.

It was a great pleasure to note the rapid advance that is being made in scientific road building, particularly through the State of Massachusetts and portions of Connecticut. A motorist, however, who ventures into Vermont over the old post roads along the Connecticut Valley, on either side of the river, will find part of the way, or, as far north as White River, some of the worst specimens of road imaginable, although I found the hilly roads lying back from the valley quite good.

Generally speaking, the roads were better than I had expected, especially in the White Mountain region, and in every direction I found plenty of evidence of progressive improvement.

GEORGE F. CHAMBERLIN.

MINOR MENTION.

T. P. Newton, a machinist of Butte, Mont., is the inventor of a gasoline carriage.

Roach & Albanus, Ft. Wayne, Ind., are fitting up their factory for the manufacture of motor vehicles.

Geo. L. Odenbrett, Milwaukee, Wis., recently exhibited a gasoline carriage of his manufacture at the local fair.

Kenneth A. Skinner, agent for the De Dion & Bouton motors in the United States, wishes to engage in a motor tricycle race with any comer.

The Kensington Bicycle Mfg. Co., Buffalo, N. Y., will manufacture the batteries for their electric carriages. They will close out their bicycle business.

The Diamond Rubber Co., Akron, O., are now prepared to make repairs on motor vehicle tires at their New York City Repair Department, 215 West 53d St. Their factory repair department will hereafter be used to take care of repairs from the territory west of Akron.

The Hudson Gas Motor & Vehicle Mfg. Co., of Saratoga Springs, N. Y., has been incorporated with $100,000 capital. The directors are: Ira B. Freyer, of Ballston Spa; Joseph P. Brennan, W. S. Robertson, William P. Tarrant and H. A. Rood, of Saratoga Springs.

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of THE HORSELESS AGE, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

A. M. Herring's "Mobike."

We have already referred to the small gasoline motors of A. M. Herring, of St. Joseph, Mich. We are now enabled to illustrate a motor tandem, called by the builder a "mobike" tandem, weighing 95 lbs., and propelled by a gasoline motor weighing 22 lbs., and developing 1 1-3 b.h.p., probably the lightest motor for its effective power that has ever been put on a commercial vehicle.

The tandem has covered about 380 miles on comparatively poor roads, and inasmuch as the care of the motor is taken entirely out of the hands of the user, the motor is still in perfect condition. No adjustment of the gas and air mixture is said to be necessary, when a given grade of gasoline is used. Ignition is effected even at starting by the small dynamo to be seen back of the oil cup, the weight of the dynamo having been reduced to 8 lbs. without impairing its efficiency.

All of the mechanism except the chains is inclosed in dust-proof casing, nearly filled with oil, continuously supplied from one sight feed oil cup. The oil cup contains two days' supply, and the motor could be run 50 to 60 miles more without damage before the oil in the casings would become too low to keep the turbine bearings and the transmitting gears in good condition. The main tank, the one on which the name is painted, holds sufficient oil for a run of eight hours—a trifle over five quarts. Directly beneath this tank is the spark coil. Alongside of this is the explosion chamber with cooling ribs, with the high speed turbine at the rear end. Above this casing are the exhaust and mixture pipes, which lead (one through and one) into the carbureter in the rear. This carbureter contains an automatic device which produces a constant mixture, varying the relative amount of opening to air and gas to suit best running conditions entirely independent of the operator. The small half-dial and pointer near the forward end of the carbureter is set by the operator for the grade of gasoline used, and needs no further adjustment for either starting or steady running in hot or cold weather. The motor is entirely free from vibration, needs no attention from the operator, who controls it and the speed of the machine with the left foot, which rests on the turbine casing just above the small lever, barely noticeable against the side of the carbureter.

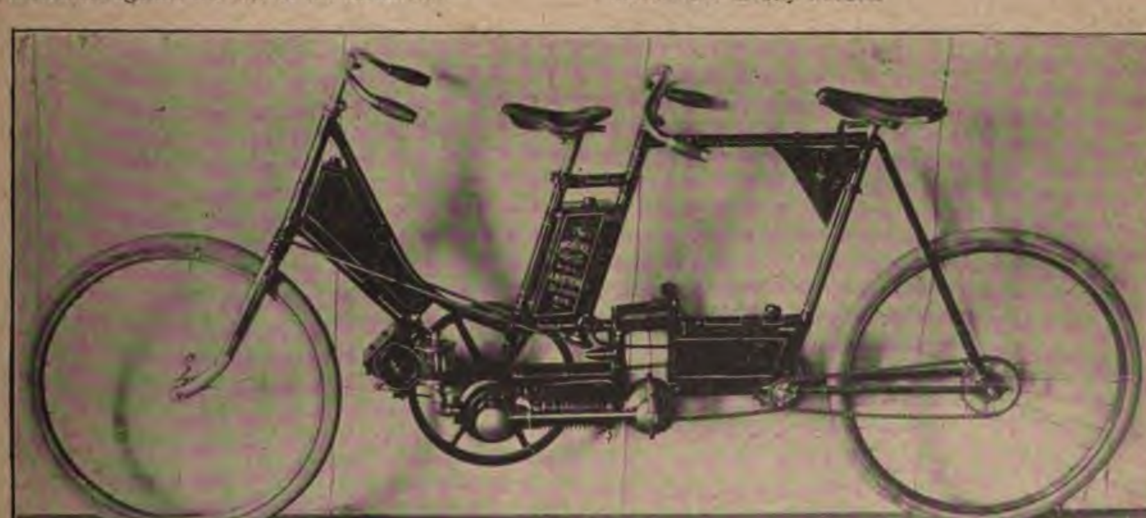
It has been found entirely safe to dispense with pedals altogether. Starting is a very simple matter, it being merely necessary to push the machine along a few paces and mount by the back step, when the engine immediately takes hold. This seldom requires a run exceeding 25 ft.

Tests of this machine on grades are said to show a capacity of mounting a 9 per cent. grade at 16 miles an hour with one rider—total weight on wheels, 273 lbs.—and without change of gear, but with two riders—total weight on wheels 400 lbs.—the machine has covered 7 miles in fifteen and one-half minutes on the bicycle path between St. Joseph and Stevensville, Mich. This path is not level, but has numerous grades, some as much as 400 to 700 ft. long and from 3 to 4 per cent. inclination, the steepest being 9 per cent. and about 80 ft. long, the hardest, however, being 720 ft. long and nearly 4 per cent.

The motor patterns and much of the inventor's material were destroyed in the Trucott Boat Mfg. Co.'s fire at St. Joseph, on the 10th of last month. He has begun on a new lot, however, which he hopes to have ready before January. The new tandems will have about 1 ft. shorter frame, and the seat will be low enough for the average rider to rest his feet firmly on the ground. The price of the new tandems, with puncture proof tires and soft saddles, will be $275. The single machines have a horizontal motor and weigh complete 75 to 85 lbs., and are sold at $250. The inventor states that either machine with one rider can mount any grade that the average rider can mount with a 72 gear. The single machine has slightly greater relative capacity, however, both in speed and hill climbing power.

Motors on the Western Mail Routes.

The mail routes in the Dakotas alone number 5,640, for which the Government pays $464,000 per annum for the transportation of mail. Sixty per cent. of this work is done by horses. Here horse feed is high, horse shoeing is expensive, harness is dear and harness repairs are no small item of expense. Could not the motor vehicle be substituted? Towns are far apart, particularly those off the lines of railroad, where motors are mostly needed.



MOTOR TANDEM OF A. M. HERRING.

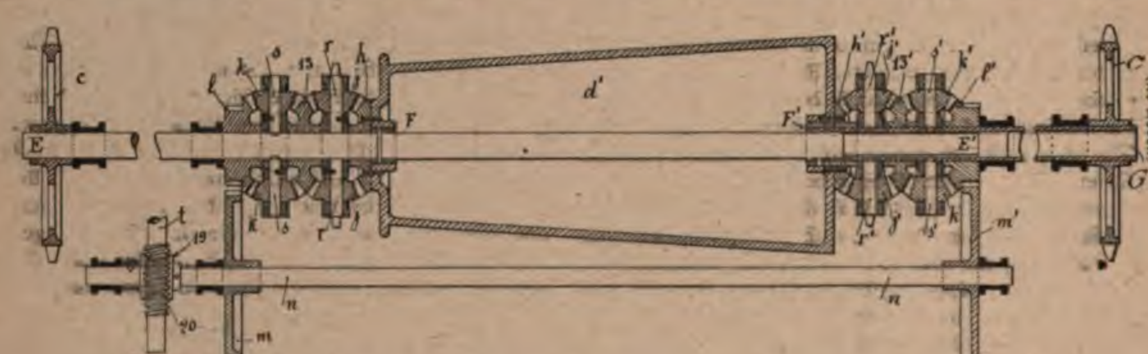
MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

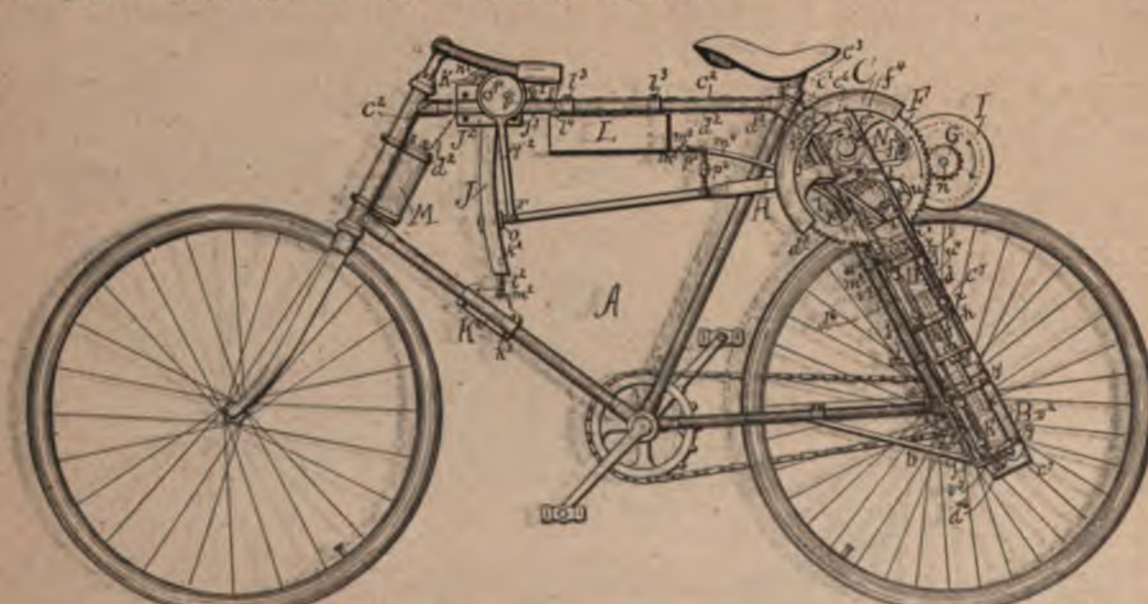
No. 633234—Speed.—Varying and Steering Device for Motor Vehicles. Edmond Draullette and Ernest Catois, Paris, France. Application filed Sept. 22, 1897.

Claim.—In a vehicle having traction wheels, the combination with a shaft E, of gearing connecting the same with one traction wheel of the vehicle, a combined spur and bevel gear mounted upon the shaft or shafts s meshing on one side with the wheel l and on the other with the wheel 13, a hollow shaft G mounted at the end of the shaft E opposite to that carrying the wheel l so as to rotate separately, gearing connecting the shaft G with a traction wheel on the side of the vehicle, opposite to the side on which is located the wheel geared to E, a conical drum d' loosely and revolubly mounted upon or between the shafts E and G, a gear wheel l', similar to the wheel l, loosely and revolubly mounted upon the shaft G, a shaft or shafts s carrying loosely mounted bevel gear wheels k' meshing with the wheel l', rigidly secured to the shaft G, a wheel 13', similar to the wheel 13, loosely and revolubly mounted upon the shaft G and meshing with the wheel or wheels k', bevel gear wheels h and h' rigidly secured to either end of the conical drum d', a differential gearing similar to that formed by the shafts s s' and wheels k and k' loosely and revolubly mounted one upon the shaft E so that the wheels j thereof mesh on one side with the wheel 13, and on the other with the



VARYING AND STEERING DEVICE FOR MOTOR VEHICLES. DRAULLETTE AND CATOIS.

wheel l loosely and revolubly mounted upon the shaft E, a wheel 13 having double-faced bevel gearing loosely mounted upon the shaft E, a shaft or shafts s rigidly secured to the shaft E at right angles thereto between the wheels l and 13, and a bevel gear wheel or wheels k loosely and revolubly wheel h and the other also so mounted on the shaft G that its like wheels j' mesh with the wheels h' and 13', a motor shaft A, gearing connecting the shaft A and the drum d', and mechanism for simultaneously rotating the wheels c and c' in opposite directions.



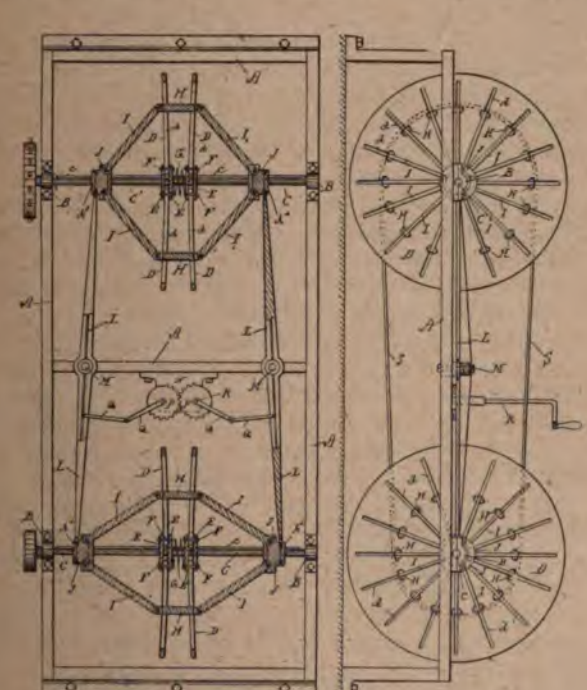
INTERNAL COMBUSTION MOTOR FOR BICYCLES. SAMUEL N. POND.

No. 633484—Internal Combustion Motor for Bicycles.—Samuel N. Pond, Chicago, Ill. Application filed April 10, 1899.

Claim.—In a motor for bicycles and similar vehicles, the combination with a multiple cylinder explosive engine adapted to be secured to the frame of the vehicle, of a forked lever fulcrumed on the driving shaft of the engine, a friction wheel journaled in and carried by said forked lever, driving connections between said driving shaft and said friction wheel, an oil receptacle adapted to be secured to the frame of the vehicle, pipes leading from said oil receptacle to the inlet valves of the engine cylinders, a cock in said pipes, connections intermediate said cock and the forked lever, a source of electricity designed to be carried on the vehicle, an electric circuit intermediate said source of electricity and the igniter mechanism of the engine, a circuit making and breaking device located in said circuit, and means connected with said forked lever and with said circuit making and breaking device, whereby the three operations of putting the friction wheel into engagement with the driving wheel, opening the flow of oil to the cylinders and closing the igniter circuit may be simultaneously performed by a single actuation of said means in one direction, and the reverse of said operations may be simultaneously effected by a single actuation of said means in the reverse direction.

No. 633426—Adjustable Pulley Gear.—George Code and Hans Knudsen, Boston, Mass., Assignors to the Liquid Air, Power & Automobile Co., of West Virginia.

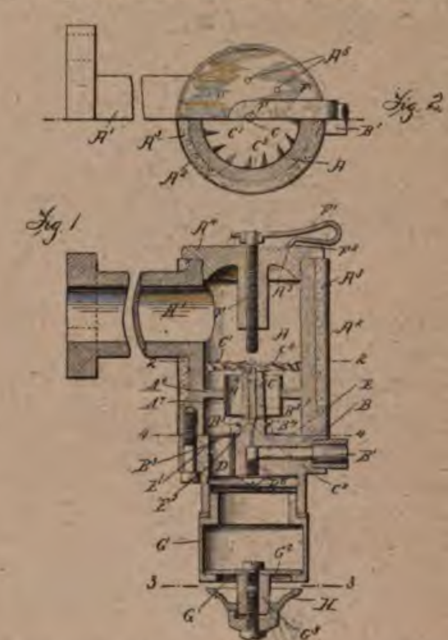
Claim.—In an adjustable pulley gear, shipper levers for operating same, two central cog wheels, an elbow joint by which each wheel is connected to its shipper lever and an



operating lever connected to one of said cog wheels whereby when said lever is moved in one direction the arms of the shipper levers to which the cog wheels are connected will be expanded or contracted according to the movement of the cog wheels, as set forth.

No. 633800—Carbureter for Explosive Engines.—Henri Edmond Casgrain, Quebec, Canada. Application filed Oct. 18, 1898.

Fig. 1 is a vertical central section through a complete carbureter. Fig. 2 is a plan of the carbureter, half in section, on the line 2 2 of Fig. 1. Fig. 3 is an under side view of the carbureter, half in section, on the line 3 3 of Fig. 1. Fig. 4 is a sectional plan on the line 4 4 of Fig. 1, and Fig. 5 is a plan of a fan mixing wheel, at its circumference, employed to "pulverize" or finely divide the oil and to control the oil valve.



A is a cylindrical vessel communicating by a branch A' with the engine cylinder, combustion chamber or admission valve chamber. At the lower portion of this vessel is a disk B, into which oil or other liquid fuel is delivered by gravitation or by a pump or otherwise from the passage B', which extends into the disk. From this disk a central pillar B^2 extends upward into the vessel A. A minute passageway B^3, "flared" at its upper end, affords communication between the passage B' and the interior of the lower end of the pillar, whence small passages B^4 extend laterally through the sides of the pillar and open into the space around it. A screw plug B^5 enables access to be had, when desired, to the passageway B^3. Within the pillar B^2 is a spindle C, adapted to rotate freely therein and carrying at its upper end a fan mixing wheel C', which has blades C^2 at its circumference, said wheel almost filling the bore of the vessel A, so that none of the explosive mixture passing through the apparatus can escape the action of the fan mixing wheel. The lower end C^3 of the spindle is tapered to constitute a valve which seats itself in the passageway B^3. Around the base of the pillar B^2 are air conduits D, extending through the disk B from the bottom to the top. A non-return valve E, with three wings E, encircles the pillar B^2 immediately below the passages B^4 and rests upon the top face of the disks, with its wings over the upper ends of the air conduits. This valve readily rises to permit air to ascend past the pillar B^2 through the passageway, which is constricted around the pillar B^2, in order that the speed of the air current through the apparatus shall be a maximum in that passageway. The valve E automatically shuts down over the air conduits D to prevent

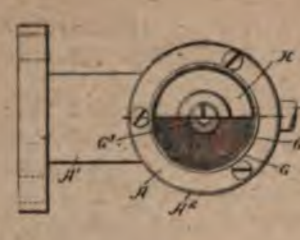


Fig. 3

Fig. 5

Fig. 4.

any return of air and vapor through them. The extent of its lift is limited by a flange B^5 on the pillar B^3, and an angular portion B^7 of the pillar passes through a corresponding angular hole E^2 in the center of the valve and prevents the valve from rotating out of its proper position above the conduits D.

The constricted passage A^8 is formed by the tube A^7, which is mounted in a partition A^6, integral with the interior of the casing or vessel A. This tube surrounds the pillar B^3 and is concentric therewith and terminates at its lower portion near the passage B^4. The upper portion of the tube A^7 extends upwardly to a point slightly below the top of the pillar B^3. The diameter of the passage A^7 may be any suitable size, but as shown it is of considerably less diameter than that of the casing or vessel A.

Air drawn by the engine through the constricted passage A^8 around the pillar B^3 will raise the fan wheel C', the extent of its lift being adjustable by the device hereinafter described. As it rises it lifts the spindle C, which raises the valve C^3 and permits the petroleum spirt or other liquid fuel to escape from the disk B by way of the passageway B^8 into the interior of the pillar B^3, whence it issues laterally in fine streams from the two small passages B^4 into the air, flowing past the wings E' of the valve E upward around that pillar. The speed of the current through the apparatus is increased upon its entry into the constricted passageway A^8, this increase of speed producing an aspiratory action upon the gasoline or kerosene, and thus tending to maintain uniformity of the flow of liquid fuel from the orifices B^4 despite any variation which may occur in the level or pressure of oil in the passage B'. The air and liquid fuel meeting and ascending in the vessel A, as described, act upon the blade C^2 of the fan mixing wheel C' to rotate the wheel, and the blades in turn react on the air and liquid, mingling them intimately and beating up and finely subdividing the oil, the explosive mixture thus produced passing to the engine by the branch A'.

The spindle C, disk C', valve C^3 and blades C^2 rise only for the suction stroke of the engine under the action of the updraft through the apparatus which acts upon the wheel to lift it and upon the blades C^2 to spin it in the direction indicated by the arrow in Fig. 5. As soon as the updraft ceases, the wheel, continuing to spin by reason of its own momentum, screws itself down in the air and vapor in the vessel A and not only permits the spindle C to drop and c... the valve C^3, but also forces that valve against its seat more quickly than if gravity alone acted on it, and also more tightly, so that the valve will not reopen accidentally under the influence of vibration or of alteration of level of the liquid fuel, but will only lift again on the occurrence of the next suction stroke.

In this carbureter the necessary fine division of the fuel is effected without the necessity of applying heat, and a nonconducting casing is employed outside the previously mention vessel A to prevent any unnecessary accession of heat to the vessel, which is provided with an outer casing A^2, within which a layer A^3 of a bad conductor of heat is retained against the wall of the vessel.

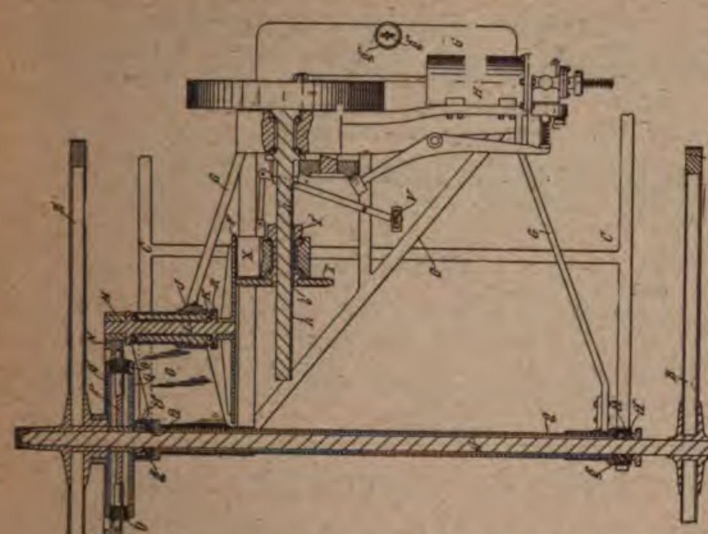
The amount of fuel supplied to the engine is controlled by a screw F, passing through the cover A^4 of the vessel A and extending down into proximity with the upper end of the spindle C. A spring arm F' is secured upon the outer end of the screw F, by which it may be screwed in or out, as desired. This spring arm has a point F^2, adapted to engage with one or more depressions A^5, formed in the cover A^4, so as to retain the screw F in any position to which it may be adjusted for regulating the amount of lift of the valve spindle C.

To guard against return flow of vapor and air from the carbureter, there is an air chamber G, screwed to the lower end of the vessel A, the air passing into this chamber through, first, a wire gauze screen G', fixed across its lower end, and, second, a leather or other suitable non-return valve G^2, secured in the airway just within the screen and forming a safeguard against return flow additional to the valve E.

The admission of the air through the screen or to the chamber generally may be controlled by a cap or disk H, screwed onto a stem G^3, extending from the lower end of the chamber G and capable of being adjusted nearer to or further from the screen, as desired. The inventor prefers to keep this carbureter cold, as by introducing the explosive mixture into the cylinder of the engine at a low temperature he obtains better results than if it were introduced hot. The expansion of the cold mixture in the hot cylinder increases its pressure, and the coolness of the entering charge reduces the quantity of jacket water or air required or obviates the necessity for relying on an external medium for cooling the cylinder.

No. 633666—Motor Carriage.—Alfred Clement Stewart, Santa Paula, Cal. Application filed March 17, 1898.

To permit of a certain amount of movement of the body backward and forward to avoid the jar that would be occasioned by the temporary retardation and acceleration of the wheels in passing over obstructions or uneven surfaces in the road, the inventor uses the flexible connection or link g'', which while it supports the front end of the motor frame does not prevent the independent backward and forward movement of the body; but as this link permits a greater or less degree of vertical movement of the front end of the motor frame independently of the movement of the body, which would jar the machinery to a greater or less extent if not controlled or counteracted, the spring g''' is rendered a compression spring by placing its ends one against the body and the other against the motor frame. In this manner it will have a tendency to keep the link connection taut and prevent any sudden jar to the motor which might occur if the motor frame could move vertically independently of the carriage body, even to the slight extent of the lost motion occasioned by the link connection. By placing the spring around the link it will be retained in position without need of other fastening. This construction



is claimed to give a very strong and simple connection between the body and the motor frame, as the link supports the front end of the frame and the greater portion of the weight of the motor and also limits the distance to which the front end of the frame and the body can be separated, while the spring graduates—i. e., modifies by degrees—the distance to which they may approach each other.

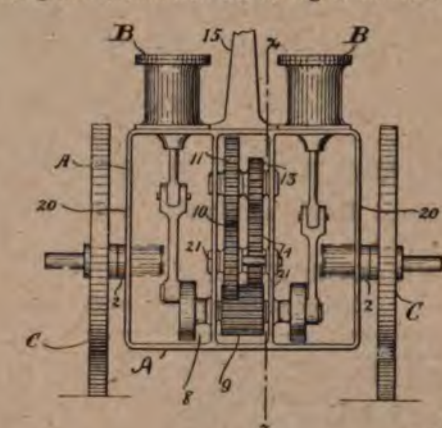
I indicates a driving disk carried by the motor frame and driven by the motor through suitable mechanism and engaging the friction disk F to drive it.

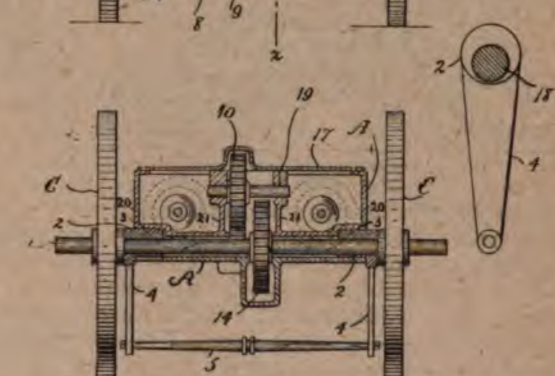
J indicates a screw-threaded sleeve carried by the frame G. K indicates a screw-threaded box screwed into such sleeve.

Since the disk F is movable toward and from the disk I, it may be moved away from the disk I until the latter has been moved upon its shaft and placed where desired, when the disk F may be moved back into engagement with the disk I. This avoids moving the disk I laterally across the face of the disk F when they are in contact with each other, as when the engine and carriage are both standing still. It also permits of the instant separation of the motive power from the carriage—as, for instance, in order to stop the carriage suddenly—and it would be impossible to wait for the fly wheel of the motor to come to a standstill."

No. 633687—Driving Mechanism for Self-Propelled Vehicles.—James Craig, Jr., New York. Application filed May 27, 1899.

This invention consists in a suitable frame or casing for the motor and motor mechanism, in which is mounted one or more gears adapted to be actuated by the motor, the said frame or casing being provided with eccentric bearings in which is journaled the driving axle of the vehicle, and in providing a means for rotating said eccentric bearings in said frame or casing, whereby the driving axle and the motor casing move relatively to each other, thereby permitting one or the other of the gears mounted in the casing or frame to be thrown into





or out of operative engagement with the gear on the driving axle of the vehicle without the use of clutches. These gears may be arranged to give different speeds to or reverse the direction of the vehicle.

The invention consists, further, in the general arrangement of the parts, whereby the entire mechanism of the motor is conveniently inclosed within a casing, rendering it less liable to injury from dirt and exposure and decreasing the noise incident to the operation of the mechanism.

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

FOR SALE.

A Haynes-Apperson two-seated surrey, with canopy top. Run about 100 miles and in good condition.

A. B. GARDNER,
Dowagiac, Mich.

STEAM VEHICLE PARTS.

Specially designed Engines, Boilers and Burners. Front and Rear Axles.

MILNE & KILLAM,
Crescent Street, Everett, Mass.

PARTS FOR AUTOMOBILES TO ORDER.

OTTO KONIGSLOW

45 MICHIGAN ST. - - - - CLEVELAND, O.

FOR SALE.

A Winton Motor Carriage in good condition. Run about 1,300 miles. New improvements recently added. Sickness only reason for selling. Can be examined and tested. Will sell for $600.00 f. o. b. Wauseon.

CHAS. YEAGER, Wauseon, Ohio.

FOR SALE.

Electric motors and set of storage batteries for light carriage.

WM. C. HOUGHTON,
157 Webster St., West Newton, Mass.

WANTED.

Machinist. First-class man only need apply. One accustomed to gas engine work preferred. Top wages to competent man. Address, giving full particulars, E. P. HOPKINS, 1302 Niagara Street, Buffalo, N. Y.

DRY BATTERIES

For Sparking Gas and Gasoline Motors.

LONG LIFE, RELIABILITY, HIGH VOLTAGE.
IN SUCCESSFUL USE FOR THIS PURPOSE.

Dow Portable Electric Assistant Co., 218 TREMONT ST., BOSTON, MASS.

WANTED.

A new or second hand 4 h. p (or over) gasoline automobile. Will take best offer under $500.00. Give full description and price. W. P. HARTFORD, Cassville, Wis.

LEONARD HUNTRESS DYER,

Specialty: Patents and Patent Causes,

908 G Street, N. W.

Cable Address: "Dyerpatent, Washington." **WASHINGTON.**

BALDWIN DETACHABLE CHAINS

made for Automobiles, in sizes to suit all requirements. Prompt deliveries made. Address:

BALDWIN CYCLE CHAIN CO.,
WORCESTER, MASS., U. S. A.

AUTOMOBILE CHARGING AND REPAIR STATION

We Make, Rent, Recharge and Repair
STORAGE BATTERIES.

THE STORAGE BATTERY SUPPLY CO.

Established 1891. Telephone, 1065 Madison Square. Incorporated 1898.

OFFICE AND WORKS: 239 East 27th St., New York City.

Seamless Cold Drawn Steel Tubing, Shells, Cylinders and Tanks, For Air, Gas, Steam, Ammonia or fluids under pressure and explosives. ☞ Seamless Steel Tested Tanks of Sundry Diameters.

DROP FORGINGS AND STEEL STAMPINGS.

JANNEY, STEINMETZ & CO., Drexel Building, Philadelphia, Pa.

SPECIAL MACHINES AND TOOLS

FOR THE MANUFACTURE OF

AUTOMOBILES.

Milling Machine.

Complete Plants Equipped. Special and Automatic Machinery Built to Drawings.

CATALOG.

Screw Machine.

THE GARVIN MACHINE CO.,

SPRING AND VARICK STREETS,
NEW YORK.

PHILADELPHIA:
The Garvin Machine Co.,
51 No. 7th Street.

BERLIN:
Deutsche Garvin-Maschinen Fabrik Aktiengesellschaft
17 Burg Strasse, Berlin C, Germany.

The Leach Motor Vehicle Co. is now booking orders for spring delivery, for its steam motor carriages. Three patterns are offered, viz.:

A two-seated mail phaeton, convertible to single seat. It is a finely finished, substantial family carriage, carrying two to six persons.

A light, road Stanhope runabout wagon built for speed on good roads and guaranteed equal to any now on the market and built **to last.**

A handsome delivery wagon for grocers, dry goods dealers, etc. Built for service and very rich and elegant in design.

We also offer Burners, Gears (including Differentials and Steering Mechanism), Engines, Boilers, etc., to the trade.

Address

Leach Motor Vehicle Co.,

210 Broadway, Everett, Mass.

Cable Address, "Leachmotor," Boston, U. S. A. "A B C" code used.

MACHINE & TOOLS

Especially Adapted for the Manufacture of . .

AUTOMOBILES.

WRITE FOR CATALOG . .

Single Spindle Profiler with Circular Table and Power Feed.

Our large stock enables us to make prompt deliveries.
Our factory being equipped throughout with large and small tools of modern design, affords superior facilities for perfecting inventions.

THE GARVIN MACHINE CO.,
Spring and Varick Sts., New York.

PHILADELPHIA:
THE GARVIN MACHINE CO.,
51 North 7th Street,
PHILADELPHIA, PA.

BERLIN:
Deutsche Garvin-Maschinen Fabrik Aktiengesellschaft,
17 Burg Strasse,
BERLIN C, GERMANY.

Premier Manufacturing Company,

Steel Crescent and Flat Base Rims
for Wire and Wood Wheels and for Tires from 28 to 36 inches outside diameter and from 1¾ to 4 inches in cross section.

We also have a complete line of HUBS, BEARINGS, SPOKES, NIPPLES, etc., etc.

CATALOGUE UPON APPLICATION.

HARTFORD, CONNECTICUT.

WE can make immediate delivery of our high-grade compound, 4, 6 and 8 H. P. reversing motor carriage engines, weighing 60 pounds, making from 200 to 600 revolutions; and our 6 and 8 H. P. copper-tube shell boilers, weighing 100 pounds; 15 inches high and 15 inches in diameter; 150 to 300 pounds pressure. Also our patent automatic burner; from 1 to 100 H. P., weighing 90 pounds; controlled entirely by the boiler pressure, and burning either gasoline or kerosene.

Will sell either separately, or the engine, boiler and burner, piped complete ready for service; and thoroughly tested before leaving the works. Costs one cent per mile to operate.

Photos and prices to bona-fide buyers only.

GRAHAM EQUIPMENT CO.,
170 Summer Street, Boston, Mass.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS

VOL. V. NEW YORK, OCTOBER 11, 1899. No. 2.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union. $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

Facts About Liquid Air.

A few facts about liquid air—a few facts—is all that is necessary to disqualify it forever from competing for the propulsion of motor vehicles and for general power purposes as well.

It takes 90 cu. ft. of atmospheric air to make a gallon of liquid air, which weighs 8 lbs. To give 1 h.p. hour 40 lbs. of liquid air would have to be raised to a theoretical temperature of 1,000 deg., which cannot be attained in mechanical practice. The pressures are so enormous they cannot be successfully controlled, a large portion of the theoretical energy being wasted in this way.

To drive a two-seated carriage 5 miles not less than 200 pounds of liquid air would be required, which at 2 cents a pound, the lowest figure worth quoting even, would bring the cost of the power alone up to $4. In addition there would be great loss and liability to accident from the complicated system of valves, pipes, condensers, heaters, etc., which would be needed to contain and volatilize the liquid. The pipes would be certain to freeze occasionally, if not heated, because of the absorption of heat from the surrounding air, and the evaporation would go on just the same if the vehicle were stopped for a period. Consequently, whether the vehicle were standing still or in motion the expense of running it would be ruinous with liquid air as cheap as water.

From the above facts it will be seen that as a source of power for vehicles liquid air is little less than a cruel hoax.

Generous Proportions.

Our readers are earnestly requested to study with care the paper of J. I. Thornycroft on "Recent Experiences with Steam on Common Roads," which is reprinted in this issue. Mr. Thornycroft's qualifications for the treatment of this subject will be acknowledged by all conversant with his record in marine engineering and his more recent honors in the field of road locomotion. One particular point, of the many good suggestions to be taken from this paper, will bear frequent repetition at this time. Mr. Thornycroft states clearly the distinction between the experimental or the show vehicle and the vehicle adapted to commercial use, and emphasizes the need of "generous proportions" in the latter if durability is to be attained.

English work wagons no doubt seem heavy to our American inventors who are endeavoring to build durable vehicles out of cobwebs and pipe stems, but Mr. Thornycroft, it will be seen, regards them as too light to meet the commercial conditions. In order to keep within the weight limit of the Act of Parliament, aluminum and special steels must be resorted to which, while saving weight, increase the cost of the vehicle, and still leave it inadequate to handle the loads required in

commercial transportation and long endure the strains. The higher rate of speed at which motor work wagons will be run also affords another reason for heavier and stronger construction, for the strains rapidly increase as the speed rises. If in England where the roads are comparatively good such weights are found necessary, what weights will be required for American cobblestones, pitchholes and muddy or sandy highways?

The youngster whittles out a top and sets it spinning on the floor; it is his revolving world. The inventor knocks together an experimental motor vehicle, sees it run out of the shop for the first time and imagines he has solved the problem of commercial horseless traction. Experiments are needful and instructive, but it must not be forgotten that the ultimate end is service, and for this durability and reliability are prerequisites.

Long Distance Lunacy.

Western newspapers print the following amusing information:

> A scheme to establish a system of long distance motor vehicle lines with Chicago as a central point is now under consideration by the Woods Electric Vehicle Co., of that city. The scheme is very much more extensive than any that the motor wagon has hitherto figured in. The plan in detail is to establish a system of cross-country runs from Chicago to Milwaukee, St. Louis, Cleveland and Indianapolis, over which electric cabs will be run on schedule time. The whole matter is yet in an exceedingly hazy state, and the routes to be selected have not yet been determined.
>
> The Milwaukee line is now pretty definitely decided upon. This week a trip to St. Louis is planned, and agents are now at work on the route to that city with a view to establishing the location of recharging stations. Maps similar to the plates of bicycle routes will be published as soon as the locations of the proposed lines are determined upon. A test trip to Milwaukee will be made at once, and it is expected the journey will be made in 12 hours.
>
> The recharging stations on the route to Milwaukee are at Wilmette, North Chicago, Kenosha and Racine, and the total cost of recharging at the four stations is to be 76 cents for an 1800-lb. machine.
>
> The rate of hire for automobiles on long trips has not been fixed, but the company insists that it will be as low as, if not lower than, railroad fares.
>
> The company plans to have all the routes opened and in use before winter. It contemplates assigning 50 automobiles to run on schedule over the routes.

More nonsense was never before jumbled together in a few newspaper paragraphs. Is it strange that the public are densely ignorant of the motor vehicle when such stuff as this is seriously offered for their edification? The notion that electric vehicles or any other kind of vehicles will be able to compete with railroad trains for long distance passenger traffic is visionary to the point of lunacy. Fifty electric cabs, we are told, are to flit airily around over the Western prairies and drive all the big trunk lines out of business. They are to be light as feathers, capable of such speed that they will be invisible to the naked eye, and will be ubiquitous if the demands of the traffic require it. The juvenile Munchausen who hatched out this latest motor canard was conscience-stricken enough to add that the whole matter was still in an exceedingly hazy state. If it ever emerges from this nebulous state, it will be in a world where natural laws are all turned topsy turvy, and time and space are both no more.

Were it not for the surprising persistence of this delusion the yarn would not be worthy of notice.

Steam Omnibuses in France.

According to our Paris correspondent, the steam omnibus is not meeting with perfect success in France. The oldest motor 'bus lines in service have been discontinued for lack of profit, and there seems to be no likelihood of a resumption of motive power unless a reduction in the cost of operation can be effected. It is evident that in this case, as in nearly all cases, the cost of operation was understated by the manufacturers, who made a few trial runs under ideal conditions, with a new machine and skilled employees in charge, and thus based their calculations on decidedly partial and imperfect data. In determining the actual running cost of a motor vehicle, nothing short of a year's actual experience, based on close figuring, is of any real value—unless, of course, fatal defects are revealed before.

In England results have been more satisfactory, we are informed, but for what reason it would be interesting to learn. Want of strength in the wheels and economy in the boilers are the reasons assigned by our correspondent for the abandonment of the enterprise in France. Across the Channel, however, wheels are now said to be giving no trouble, and as to the boilers, they are economical enough to be driving the horse out of his occupation in heavy draft work. Has the cost of fuel anything to do with it? Or is there some special reason, not stated, why the two stage routes mentioned did not pay?

We anxiously await a full explanation.

Lame Excuses.

Electric vehicle promoters in Europe are wonderfully fertile in excuses. The London electric cabs were withdrawn because the motormen were hired away by private owners of automobiles; the electric cabs of Paris were taken out of the cheap cab class because the drivers were in continual squabbles with their fares, and now we learn that the Brussels electric cabs have been discontinued because the brakes didn't work right.

Such shuffling deceives no one who understands the difficulties of storage battery locomotion. Why not come out frankly and admit that all these lines were discontinued because they did not pay, and that all similar enterprises must be sooner or later discontinued for the same reason? Truth trifled with will revenge itself on somebody.

Liability of Fire.

A question now occupying the minds of many users of motor carriages is what will be the attitude of the fire underwriters toward the storage of gasoline for use in steam and gasoline vehicles. Liability to fire will certainly be enhanced if large quantities of this hazardous liquid are permitted to be stored in the stables of private owners of automobiles. Hence the quantity allowed in any building of this kind will probably be fixed at a few gallons, and this, it seems to the editor, should be kept in the tanks of the vehicle or vehicles stored therein. The main source of supply should be a tank outside, sunk in the earth or otherwise protected, securely fastened against molestation, and drawn from as occasion requires.

Such an arrangement would reduce the danger of fire to a minimum and place the responsibility for the care of the inflammable liquid generally in the hands of competent persons, i. e., either the owner himself or some one employed by him to do the work.

In buildings where children may play and older ones meddle the screw caps of gasoline tanks should be locked in some manner.

Work for the Automobile Club.

The Automobile Club of America has completed its organization and entered upon its first winter's work with the brightest prospects. Among the first matters to engage its attention should be the law forbidding the use of steam vehicles in New York State, except on conditions that are virtually prohibitory, and the ordinance excluding motor carriages from the parks of New York City.

The latter stumbling block will no doubt be easily removed, but it is quite possible that an amendment of the former is as much as can be expected. The red flag portion of the law is obviously unnecessary, but some supervision over steam boilers in vehicles will probably be found necessary. Just what this supervision should be, with due regard for the safety of the public and the rights of the user, would be a good subject for the Automobile Club to discuss.

Our columns are also open for a general discussion of this subject.

Gas Engine Formulas.

A subscriber who is trying to build a gas engine, writes that he does not understand the gas engine formulas that have recently been published in The Horseless Age, because he has forgotten all the algebra he ever learned; he advises the editor to give plain facts that will enable any one who knows nothing of algebra or any other science to build a gas engine. While the editor wishes to encourage in every possible way all judicious efforts for the solution of the problems relating to the mother vehicle, he deplores the useless waste of time and money by hap-hazard experimenters who ignore the underlying principles of the explosive engine, yet hope to arrive at tangible results. In the premises he feels justified in offering a little advice himself, which is that all who are ignorant of algebra and the mechanical sciences and who despise these branches of learning should let gas engine and motor vehicle construction severely alone.

The Spirit of Inquiry.

It is with pleasure we note that the long silence which has reigned among American motor vehicle students has been broken at last, and our columns begin to show a very encouraging interchange of opinion. It is a most hopeful sign. The advantages of the industrial or mechanical student in these modern times are every day multiplying, and not the least of these advantages is an up-to-date technical journal, in which all important questions relating to the art or industry of his choice are freely and fearlessly discussed. The newer the art or industry the more valuable this discussion. We repeat that we welcome this spirit of inquiry, and urge all our readers to think over the issues raised and participate in the discussions.

The hysterico-promotion period is passing by, and we can now lay hold of the work before us with calmness and good judgment; therefore with the assurance of success.

The Trailing Wagon.

Experiments with the trailing wagon in Liverpool and other English commercial centers prove that it is not fitted for wharf and warehouse service, where narrow turns must be made and loads taken on and off in contracted spaces. Load and motive power must be carried by the same wheels in these cases, and the trailing wagon or longer wagon train must be restricted to the rural districts and sparsely settled countries where there is abundance of room for loading and unloading.

Fairmount Park Open.

The report of the committee of the Fairmount Park Commission, which was appointed to examine into and report upon the advisability of admitting automobiles to the Park drives, and which is to submit its report at the next meeting of the Board, Oct. 13, is said to recommend that certain drives be opened to automobiles as an experiment, other drives to be opened in the spring if the experiment is a success.

Constitution and By-Laws of The Automobile Club of America.

The Automobile Club of America, whose objects and whose incorporation were recently announced in these columns, has adopted a constitution, the chief features of which are as follows:

Not all members need be owners of motor vehicles.

The club will be supported by members' subscriptions.

There are to be four classes of memberships—honorary, life, active and associate. The honorary members are limited to 25, the active to 400 exclusive of life members, while the associate and life members are not limited.

The officers are to comprise a president, first, second and third vice-presidents, secretary, treasurer and consulting engineer.

The general management is vested in a board of nine trustees, exclusive of the president, first vice-president and secretary, who are ex-officio members of the board.

All the officers are required to be owners of automobiles.

The annual meetings are to be held on the second Monday of October. Other meetings may be called by the board of governors.

A quorum constitutes 25 active members.

The board of governors are to hold meetings on the first Monday of each month. Five of them constitute a quorum. At the first annual meeting nine governors will be elected, three of whom are to retire in one year, to be replaced by three more to be elected by the club, three in two years and three in three years.

Five committees are to be appointed: Membership, of three; house, of five; exhibitions, contests, runs and tours, of three; laws and ordinances, of three, and an auditing committee, of three.

Elections are to be by ballot.

The board of governors have power—

1. To appoint additional committees.
2. To fix penalties for the violation of rules.
3. To remit penalties.
4. To elect members.
5. To make rules for their own government and the government of the committees appointed by them.

The first vice-president shall be chairman of the board of governors.

The secretary is to keep a record of all club tours and runs, and also a record of the automobiles owned by members.

The committee on exhibitions, contests and tours shall arrange for and act as judges in such matters.

The committee on laws and ordinances shall examine and report on such laws as affect the use of automobiles and shall take action, subject to the approval of the board of governors, to maintain the rights of the automobile.

The board of governors may appoint to associate membership members of foreign automobile clubs during sojourn in this country for a period not exceeding three months without liability of annual dues.

Assessments not exceeding $10 in any one year may be levied upon the members by a vote of three-fourths of the active members present at a meeting of the club.

A member may personally introduce strangers to the club house for one day.

No gambling is to be allowed.

The club's automobiles may be hired by members or seats may be engaged therein for runs or tours, at the discretion of the house committee.

A meeting of the club has been called for next Monday evening at half-past eight o'clock, at the Waldorf-Astoria Hotel, to receive the report of the Acting Executive Committee, the constitution and by-laws, and to discuss such other matters as may come before it.

The Darling Steam Carriage.

F. A. Darling, Franklin, Mass., has constructed a steam carriage for his own use. The boiler is of the regular upright pattern, 13 in. in diameter and 30 in. high, and contains 26 tubes and water fire-box. It carries 250 lbs. of steam. Around the boiler are two coverings, the inner one being asbestos and the outer Russia iron. The tank in the back of the wagon body holds 10 gallons of water. Coke is used for fuel, the box containing 100 lbs. A storage battery supplies four lights—two headlights, a red light at the back and a green light in front of the steam gauge.

The engines run either cross compound or high pressure on both cylinders; the small cylinder has a diameter of 1¾ in. and the large one 2½ in., while the stroke of each is 3½ in.

Power is transmitted by means of a jack shaft, first being taken from the engine by a chain and then to the wheels by a small spur gear on each end of the jack shaft, acting on an internal gear bolted to the hub. The outside of these internal gears is used for a brake. Around each gear is a leather band, which is connected to a small steam cylinder. Steam can be let into this cylinder at any time, causing the bands to tighten and act as brakes.

The wheels, of Mr. Darling's own pattern, are 34 front and 38 rear. The hubs are of cast steel and contain roller bearings. The hickory spokes are forced into a groove on the outside of the hub and bolted through the two flanges. Pneumatics of 2½ in. diameter are used.

The weight of the vehicle complete is 1,000 lbs.

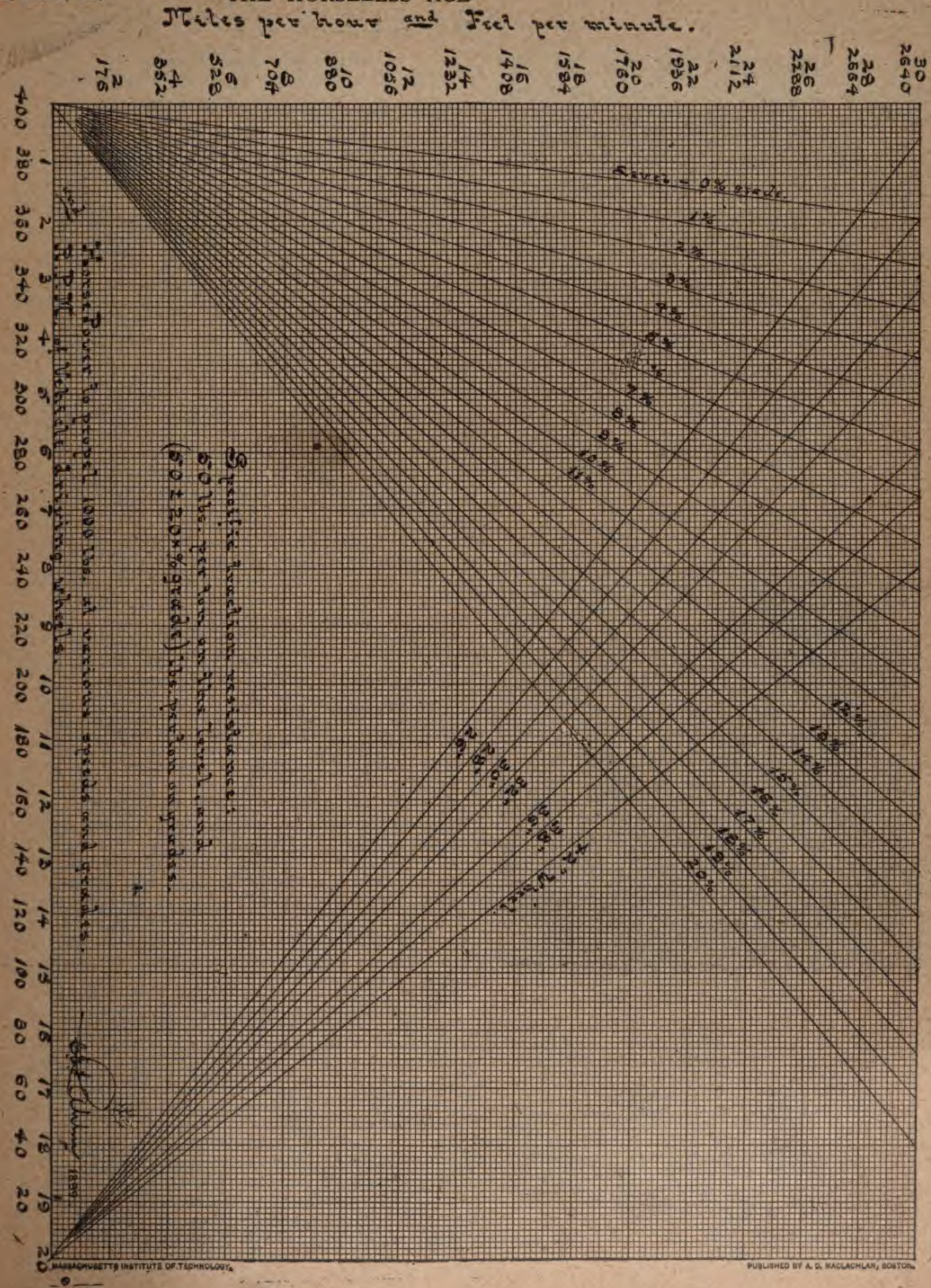
Power and Speed Curves.

By C. E. F. Ahlm.

In calculations and controversies relative to motor vehicle work, it is frequently desirable to quickly compare different points especially in questions as to speed of vehicles with different driving wheels, and motor horse power required at various speeds and grades. The most convenient way for quick comparison is undoubtedly by charts and diagrams, and the writer believes that the accompanying curves will be found very useful to the motor vehicle builder.

The vertical top and bottom figures refer to both sets of curves and represent miles per hour and feet per minute, respectively, as indicated. The horizontal top figures marked 00/0 and 1 0/0, etc., represent horse power required to propel 1,000 lbs. on the level and on various grades. The horizontal bottom figures refer to the curves marked 42-in. wheel, 38-in., 36-in., etc, and indicate number of R. P. M. of driving wheels.

In preparing these curves the specific traction resistance was taken at 50 lbs. per ton (2,000 lbs.) as being the best average for ordinary city travel, and does not include friction of gearing or air resistance and the like, which is a variable factor.


Miles per hour and Feet per minute.
Level – 0% grade
Horse Power to propel 1000 lbs. at various speeds and grades.
Specific traction resistance:
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
PUBLISHED BY A. D. MACLACHLAN, BOSTON.

Referring to the curves, suppose we desire to know what speed our motor should have to drive the vehicle 17 miles per hour, assuming the driving wheels to be 36-in., and the gear reduction 1-10. Following the horizontal line indicating 17 miles per hour until we reach the diagonal marked 36-in., we find by proceeding down the vertical line that this corresponds to 160 R. P. M. of the driving wheels; multiplying this by the speed reduction, which is 10, we have the speed of our motor = 1,600 R. P. M.

From the motor speed may be found the speed of vehicle for various driving wheels when speed reduction is known. In order to find the horse power required to drive a vehicle weighing 1,000 lbs. total, at a speed of 17 miles per hour, we proceed in the same manner, reading off directly from the top figures at the bottom of the chart. For example, on the level it would take in this special case 1-13 h.p. and 7-95 h.p. on a 15 per cent. grade—that is, a grade having a 15-ft. rise to 100 ft. In like manner is found the power required for any weight of vehicle at any speed and grade. Vice versa, if horse power of motor and grade are known, the curves will readily tell speed of vehicle, etc.

In general, the curves will be found extremely useful for quick solution of the more important practical questions identified with motor vehicle work.

NEW MODEL CROUCH STEAM CARRIAGE.

MINOR MENTION.

Chicago has an automobile show on the tapis for this winter.

The Keystone M. & M. Co., Reading, Pa., are building a motor vehicle.

The Daimler Mfg. Co., Steinway, L. I., have issued a very elegant catalogue of their marine motors.

The Columbia & Electric Vehicle Co., Hartford, Conn., have broken ground for an addition to their factory.

Daniel Best, San Leandro Cal., is finishing a light and fast gasoline carriage, which he expects to run on country roads.

A combination is reported on foot in the vehicle trade. Upon the consummation of it it is said automobiles, as well as horse vehicles, will be manufactured.

Geo. N. March, 32 Hawley St., Boston, Mass., is organizing the Colonial Automobile Co., to manufacture steam vehicles, cycle boats and felt-edged rims for pneumatic tires.

F. E. Stanley, designer of the Stanley steam "Locomobile," appeared before the Boston Park Commission last week and argued for the admission of motor carriages to the city parks.

Don Manuel Oliva, Don Martin 57, Madrid, Spain, owner of the largest omnibus and cab transfer company of Spain, wishes to receive literature and catalogues from American motor vehicle builders.

A judgment for $820 has been entered against the National Motor Carriage Co., 1 Madison Ave., New York, in favor of C. A. Tower and Geo. L. Weiss, of Cleveland, O., who had made prepayments on carriages which were never delivered.

According to the Brooklyn Eagle, Adjutant General Corbin thinks that the automobile will not be long popular among American aristocrats, for the reason that the swell ladies make a better appearance behind a spanking team, and love to drive themselves.

W. P. Kidder, Jamaica Plain, Mass., has completed his first carriage, and given it very satisfactory road tests. The chief feature is a system of direct gearing, doing away with sprockets and chains, on which broad patents have been allowed in the United States and applied for in 25 foreign countries.

Three electric vehicles ordered by the U. S. Signal Bureau, Washington, D. C., have arrived and are being tested at Fort Myer. Two are of the delivery type and the third is a light runabout. All of them are fitted with attachments so that horses can be used when there are no facilities for charging the batteries.

The Automobile Co., of Hawaii, has been incorporated at Honolulu with $2,000,000 capital to introduce electric vehicles in the Hawaiian capital. A charging plant to cost $100,000 will be installed, capable of supplying 100 carriages. Thirty Woods electric vehicles have already been purchased. The roads in Hawaii are excellent.

The Leach Motor Vehicle Co. have opened an office and works at 210 Broadway, Everett, Mass., and are manufacturing a steam carriage carrying two or four persons, with both seats facing forward, the rear seat being removable. John M. Leach is president and general manager, W. A. Faulkner treasurer and Frank R. Miller secretary.

Recondensation of Steam in Steam Motor Vehicles.

In my article which appeared in The Horseless Age of April 5th, 1899, entitled "Some Thermodynamics of Vehicle Motors," I referred to an invention of mine for the recondensation of steam. In The Horseless Age of the 20th of September a subscriber asks for further particulars concerning my method for recondensation of steam.

By the use of high pressure steam for the propulsion of motor vehicles, the weight of engine and boiler may be reduced to a minimum. As devices have already been worked out and put into operation by various inventors for successfully controlling steam carriages and for the automatic regulation of the fire, the chief remaining problem appears to be the practical recondensation of the steam, in order that pure water may be continually used in the boiler, which necessarily consists of small tubes, as fouling or incrustation of the boiler not only greatly lowers its efficiency, but endangers the burning out of the tubes.

Atmospheric condensers are employed with considerable success. To be efficient, however, an atmospheric condenser must present a very large amount of surface to the atmosphere. This has many disadvantages.

I have proposed the use of a water condenser, either alone or as a supplement to an atmospheric condenser for the condensation of steam in motor vehicles.

As with a motor vehicle, it is not so much a question of economy of fuel consumption for the supply of steam as it is to take care of the exhaust steam; the fuel expense in any event being very low, some of the efficiency of the engine may be sacrificed for convenience and efficiency of condensation. Therefore, by admitting the exhaust to a condenser under a sufficient back pressure to cause the temperature of steam in the exhaust to be somewhat above that of boiling water, the steam may be effectually condensed by imparting its latent heat of liquefaction to water to evaporate the same under atmospheric pressure in a water reservoir surrounding the condenser tubes. The escaping steam being gently and steadily given off from the boiling water, may be passed into the products of combustion of the fuel to become heated and absorbed, and thereby made invisible. Of course, in this event it will be necessary to carry a supply of water for the purpose of condensation in excess of the weight of water which would be required with an atmospheric condenser; yet, on the other hand, the water condenser, on account of its smaller size, will of itself weigh much less than an atmospheric condenser of equal efficiency, and will offset, in a measure, the extra weight of water.

It is obvious that for the purpose of condensation water may be used without regard to purity or hardness, and which may, therefore, be picked up anywhere on the road, pure water being used in the boiler.

When a water condenser and atmospheric condenser are employed together, the atmospheric condenser may be made quite small and still take care of the steam from the exhaust of a steam cab or delivery wagon, or similar vehicle where short periods of movement are followed by short periods of rest, in which event the water condenser may also be made very small and still be capable of liquefying the excess of exhaust during the necessary periods of active work under full load to take the vehicle over stretches of bad road and up heavy grades.

When the exhaust from the engine becomes in excess of the capacity of the atmospheric condenser, the pressure will gradually mount therein, until the cooling water surrounding the steam tubes in the water condenser begins to boil and 2 or 3 lbs. back pressure is reached. If the engine be run to its full capacity for a comparatively long period, the back pressure in the exhaust necessary to the condensation of the steam may rise to 5 lbs. Five pounds pressure causes such active boiling of the water surrounding the steam tubes that 5 lbs. may be taken as the limit of back pressure necessary to efficiently condense all of the steam, even under the most trying conditions. To accomplish this the condenser may be a comparatively small affair relatively to the size of the engine and vehicle. The steam tubes should, of course, be made light and small. As they are not subjected to any considerable degree of pressure, they may be made excedingly thin, and should consist of copper.

The importance of pure water in a light tubular boiler for motor vehicles is a very weighty consideration. The following are some calculations of the loss in efficiency of an engine using steam at 250 lbs. and exhausting against 5 lbs. back pressure above the atmosphere, as compared with exhausting against atmospheric pressure. The calculations are based on the fuel consumed.

In making the comparison, it is presumed that pure water be used in both cases, while, as a matter of fact, in practice, where the steam is not condensed, the water in the boiler would not under ordinary conditions be pure, and the fouling and incrustation of the boiler would lower its efficiency much more than 5 lbs. back pressure will lower the efficiency of the engine using pure water with no incrustation and no fouling of the boiler.

Calculations of Relative Efficiency of an Engine Using Steam at 250 lbs. Pressure, Exhausting into the Air, Compared with Exhausting Against 5 lbs. Back Pressure Above the Atmosphere.

	Heat Units.
Total heat in 1 lb. of steam at 250 lbs. pressure......	1,205.3
Total heat in 1 lb. of steam at atmospheric pressure...	1,146.1
Difference in total heat in 1 lb. of steam between 250 lbs. pressure and atmospheric pressure............	59.2
Total heat in 1 lb. of steam at 5 lbs. pressure above the atmosphere..................................	1,150.9
Subtracting, total heat in 1 lb. of steam at atmospheric pressure..................................	1,146.1
We have a loss of..................................	4.8

equal to 8.1 per cent.

Under 5 lbs. pressure in the exhaust or condenser, the feed water returns to the boiler 16 degrees hotter than were it returned at atmospheric pressure. Under 5 lbs. pressure the steam is condensed at 228 degrees instead of at 212 degrees. As the total heat needed to raise 1 lb. of water from 212 degrees and evaporate it under a pressure of 250 lbs. is 1,025 heat units, the 16 heat units utilized in the feed water represents a saving of 1.6 per cent.

We must, therefore, subtract from the above loss of 8.1 per cent. the excess of heat returned in the feed water, or 1.6 per cent., leaving a balance of 6.5 per cent. loss of heat or efficiency, which represents the cost of the convenience of condensing the steam in an efficient and practical way, and at the same time enabling the use of pure water in the boiler, obviating any incrustation or fouling of the boiler and consequent loss of heat by lowering its efficiency. It would take but a very slight incrustation or fouling of the boiler to lower its efficiency very much more than 6.5 per cent.

HUDSON MAXIM,
891 Sterling Place, Brooklyn, New York.

PROGRESS IN PARIS.

(From Our Own Correspondent.)

NEW FEATURES OF THE ASTER MOTOR.

The Aster motors, with copper radial ribs, have a defect in that the expansion of the brass of the cylinder and the copper of the ribs is unequal, leading to imperfect cooling. To remedy this defect a fusible alloy serving as a conductor has been placed between the brass cylinder and the ribs, which is said to accomplish the desired purpose, and is very ingenious to say the least.

PARIS—ST. PETERSBURG.

As reported in my last letter, the emissaries of the Automobile Club who investigated the Russian roads found the conditions so bad that no race to the Russion capital can be run next year. It is quite possible, however, that the race will take place in 1902, as the Secretary of Roads and Bridges told the emissaries that extensive road repairs were going on, but would not be completed for two years.

PEKIN TO LONDON.

But if we cannot have the Paris-St. Petersburg contest in 1900, we shall nevertheless have something much more startling in the projected tour of Dr. Lehwess, of the Automobile Club of Great Britain, from London to Pekin, a distance of about 8,000 miles. Such a journey may be possible at great cost and with great hardship, but it is pertinent to inquire how this intrepid sportsman will get his supplies of gasoline, water, etc., in some of the out-of-the-way places he must traverse. The carriage employed, which will be built by Koch, the kerosene motor manufacturer, will soon be shipped to Pekin, China, from which point the doctor expects to set out next March.

RACING AND TOURING CARRIAGES.

Until I see some proof to the contrary I shall not cease to repeat that automobiles built for racing and touring purposes, which are able to cover long distances at high speed, are unfit for ordinary city work. The frequent starting, stopping and numerous changes of speed incidental to every-day urban use, the sudden jerks and changes of temperature, are a much severer strain on the motor and mechanism than the overwork of a straight journey of 150 to 200 miles at an average speed of 20 to 25 miles an hour. Builders ought therefore to turn their attention to solidity and durability of construction and economy of operation instead of speed.

STEAM OMNIBUS LINES DISCONTINUED.

The National Automobile Co., which was one of the few companies operating steam omnibuses in France, and which had several lines around Paris, among them the routes from St. Germain to Maisons Lafitte, and from St. Germain to Ecquevilly, has discontinued its service. The company began business in 1896, employing De Dion steam 'buses seating 20 passengers. The municipal councils of the communes through which the lines ran refused to grant the company any subsidies, and it is therefore to be inferred that the receipts were not large enough to pay the running expenses. This is to be regretted. These omnibuses, while heavy and noisy, are not dangerous to traffic if the speed is limited to 9 or 10 miles an hour. The chief desiderata are an economical boiler and strong wheels, and in these points heavy vehicles in France have so far been lacking. If the omnibuses are to go, I am informed, nevertheless, that motor trucks will soon appear in great numbers. (?)

ELECTRIC OMNIBUSES IN BRUSSELS.

Three or four months ago a Belgian company tried to operate electric omnibuses in Brussels over the hilly road from the Stock Exchange to Ixelles. The hill of the Rue de la Montague, which is on the route, is very long and steep, and after several weeks' trial the company has given up its exploitation, alleging as a reason that the brakes of the omnibuses were not efficient. If this is the only reason why the experiment was not successful, then by all means let us have the experiments conducted on a level road where brakes are not so important.

LIGHT STEAM CARRIAGES.

The appearance in the Paris-Boulogne race of two of the Stanley "Locomobiles" has started a fresh discussion of the merits of such vehicles. All these voiturettes, in my opinioin, are too lightly built to last, and the maintenance of the boilers must be a rather heavy item. The high cost of petroleum in France is a barrier in the way of the popularity of all steam carriages heated in this way, on account of the much larger consumption of fuel than is required in a gasoline engine.

MOTOR VEHICLES IN THE FRENCH COLONIES.

A company has just been organized for the introduction of motor vehicles in the French Soudan. The head of the company is M. Felix Du Bois, the well-known explorer, of this country. The trucks used will be of the Amedee Bollee type, of 9 h.p., and are being constructed by the De Dietrich Co., of Luneville. It is said there will be 80 of them. While the experiments so far conducted in the Soudan have not been perfectly successful, they were useful in pointing out changes which could advantageously be made in the vehicles to better adapt them to the conditions to be met. As the cost of transportation is very dear in these colonies, the chances of the motor vehicle seem to be excellent there.

Another similar company is about to introduce motor transportation in Madagascar until the railroad from Tamatave to Tananarive is constructed. De Dion steam tractors will be employed, and inasmuch as all the new roads and bridges have been constructed with a view to the passage of these heavy vehicles, and the cost of transportation is extremely high at present, the outlook for the company is rather favorable.

LONDON NOTES.

SOME NEW GERMAN ELECTRIC VEHICLES.

An important feature of the motor exhibition which has just been held in Berlin was undoubtedly the large number of electric vehicles exhibited. Prominent among them was the large display made by Die Gesellschaft für Verkehrsunternehmungen, of 42 Unter der Linden, Berlin, N. W., a new concern which has lately been started and in which a number of prominent German electrical engineering concerns are interested. The company are devoting attention to both heavy and light electric vehicles, and specimens of each type were displayed. The largest vehicle on the stand was the electrical omnibus illustrated in Fig. 1. This has seating accomodation for 12 persons, while in accordance with the practice on the Continent, there is room for six passengers on the rear platform. The motor and transmission gear are mounted on a tubular frame, to which the body, entirely distinct, is attached through the medium of strong springs. Two Siemens & Halske motors are employed in the 'bus. They are attached by springs to the frame in a special way to take up any

FIG. 1. ELECTRIC OMNIBUS AT BERLIN, GERMANY.

jerking at starting, and are geared by spur wheels, one motor to each of the gear wheels. The battery consists of 44 Pollak cells, arranged in two sets under the seats. Unfortunately we are unable to give the weight or electrical capacity of the battery, but it is stated to be sufficient for a run of from 10 to 12 miles on one charge. The controller switch, which is distinct from the steering standard, is arranged to take a number of positions, to give a wide range of speed, as also a slow reverse motion, while in one position of the switch the motors are made to act as brakes, to be used in case of emergency, being sufficiently powerful to pull up the 'bus in a space of less than 2 yds., even when going at full speed. Movable contact bars are provided on the roof of the 'bus to enable the accumulators to be charged from the overhead conductors of the trolley street railways. Steering is effected as usual through the front wheels by means of a vertical hand wheel. In addition to the electric brakes, shoe brakes on the rear tires are provided. The wheels are of strong construction, and are fitted with ball bearings. The center of gravity of the vehicle is low down, increasing its stability. The weight of the 'bus in running order, but without passengers, is given as 3½ tons.

Fig. 2 illustrates one of the company's light vehicles, a closed coupé. In this class the motor and transmission are mounted on a special duplex tubular frame, so that any form of vehicle body may be mounted thereon through the medium of plate springs. Two motors are employed, one to each of the rear wheels, the connection being made through spur gearing, inclosed in dust-proof cases. The accumulators are arranged under the front and rear seats, as shown in dotted lines, and are stated to have a capacity sufficient for a run of about 25 miles on one charge. Steering is controlled by a bar. The

FIG. 2. ELECTRIC COUPE.

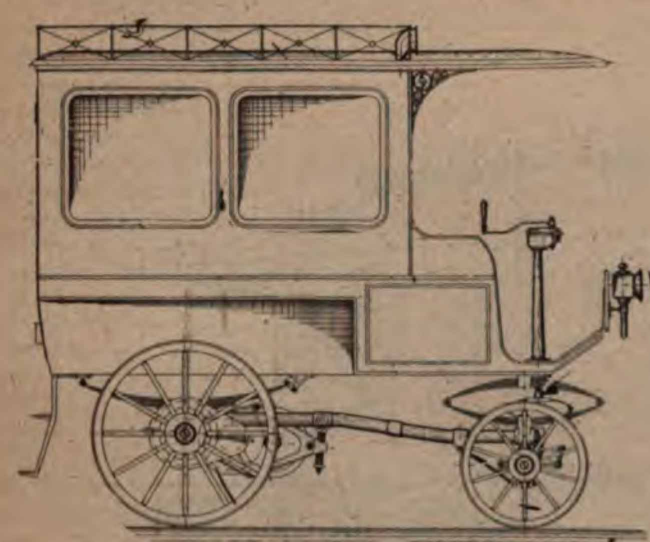


FIG. 3. HOTEL OMNIBUS.

controller switch, which in this class of vehicle is combined with the steering standard, is arranged to give four forward speeds, a reverse motion and an electric brake. The coupé can, it is claimed, attain a maximum speed of 12 miles an hour, its weight being given as 2,420 lbs.

FIG. 4. WAGONETTE.

A heavier class of electric vehicle built by this company is illustrated in Figs. 3 and 4, the former showing a hotel omnibus and the latter an eight-seated wagonette. In this case again, a standard frame is adopted, to which any type of body can be attached, one of the vehicles at the exhibition in this class being a parcels delivery van capable of carrying loads up to one ton. The spring suspension features, both as regards the body and motor, are retained, but in this case only one motor—a Lahmeyer—is employed, geared to the rear axle, on which is mounted a balance gear, by spur wheels working in a dust-proof oil-containing case. The accumulators, which are of the Majert type, are located under the driver's seat; doors are provided at each side to permit ready withdrawal of the battery, while the seat itself may be lifted up to permit of the accumulator connections being examined. The capacity of the battery is given as from 25 to 30 kilometers on one charge. The controller is adapted to give four speeds forward and one backward, also an electric brake. The weight of the vehicles illustrated in Figs. 3 and 4 is given as about 3,960 lbs.

MOTOR TRICYCLES.

The latest English firm to take up the construction of motor cycles is Perry & Co., of Birmingham, the well-known makers of cycle chains. The firm has been experimenting with automobiles for some time, and one of their first productions is a motor tricycle fitted with a 1¾-h.p. gasoline motor. The Bard Cycle Co., Ltd., of Barn St., Birmingham, have also taken up the manufacture of motor tricycles, the motor they are using being the well-known De Dion.

MOTOR OMNIBUS SERVICE IN LONDON.

At last London is to have a service of motor omnibuses. The London Steam Omnibus Co., Ltd., was formed with a flourish of trumpets a year or so ago, and quite recently the title of the concern was altered to the Motor Traction Co. Seeing that the 'buses about to be put in service by this company are driven by gasoline motors, the change in title is a desirable one, as it would be somewhat paradoxical for a steam omnibus company to be running gasoline vehicles. The start, which is to be made next week, between Kennington Gate and Victoria Station via Westminster Bridge, will be a modest one, as only two vehicles are to be put on the service. The motor is of 12 h.p., and the vehicle has accommodation for 12 inside and 14 outside passengers. Ordinary 'bus fares will be charged.

A NEW STEAM CARRIAGE.

A new steam vehicle has just made its appearance at Taunton, having been constructed by Beach & Co., of the Pioneer Motor Works, that town. Comparatively few details are so far available of the new vehicle, which takes the form of a covered delivery wagon. The boiler, which is of the vertical type, and located in front, is fired by liquid fuel supplied by a double burner, and 60 lbs. of steam can, it is claimed, be raised in 15 minutes from the time of lighting up. The engine is of the single cylinder vertical type; it is of 5 h.p., and works with steam at a pressure of 150 lbs. per square inch. Two speeds are provided—5 and 10 miles per hour—the variable gear being controlled by a special friction clutch. The front whels are 36 in. in diameter, and the rear wheels 46 in., the wheel base being 6 ft. 6 in., and the gauge 4 ft. 6 in. Water sufficient for 15 miles and oil for 40 miles can be carried. The weight of the vehicle complete is given as 2,850 lbs.

MOTOR CONSTRUCTION IN AUSTRIA.

A new company is in course of formation in Vienna under the auspices of the Austrian Länderbank to undertake the construction of horseless vehicles in Austria. The bank in question is reported to have acquired on behalf of the new company the Austrian and Hungarian patents in the Amédée-Bollée vehicles of De Dietrich & Co., and also to have purchased the old engineering works of Escher Wyss & Co., at Lesdorf, near Vienna, where the construction of automobiles will shortly be commenced.

MORE COMPANIES.

During the past week rumors have been current anent the impending flotation of several new joint stock companies in connection with horseless vehicles in England. In each case the capital extends in pounds sterling to six figures. The firms to which the finger of rumor points are the Liquid Fuel Engineering Co., builders of the Lifu steam vehicles, and the Pennington-Baines Co., while a third company is in course of formation to control the De Dion & Bouton patents in the United Kingdom.

Wolverhampton is rapidly becoming a motor construction center. Three concerns have been at work for some time past, while now it is announced that the Wearwell Cycle Co., Ltd., of that town, is taking up the construction of a $300 horseless vehicle.

COMMUNICATIONS.

The Pneumatic Cushion-Spring Controversy.

New York, Oct. 6.

Editor Horseless Age:

Since the publication in the issue of Aug. 23 of an article describing my pneumatic cushions, an interesting correspondence has appeared in your subsequent editions respecting the value of air as a cushion.

Mr. Graham, of Boston, maintains that air is not a cushion, but that it is a solid body, and that it never can be used as a spring, because it is not an absorber. Two of your correspondents, one H. L. Rambeau, of Cincinnati, and another from St. Louis, who signs his initials only, G. E. U., have answered Mr. Graham pretty effectively.

Now comes F. H. Bolte, of Peoria, Ill., in your issue of Oct. 4, and argues that air is not a cushion under all circumstances. This general statement is undoubtedly true. Air is a cushion only when it is used in such a way that it becomes effective as a cushion. Mr. Bolte calls attention to the use of air under such conditions, where, as he claims, it cannot possibly act as a cushion. In starting from these premises, he reasons that air is not a cushion under all circumstances. So far as that goes I agree with him, but I take issue with him when he says, "If rubber is confined so it cannot expand, as for instance a rubber tire in a steel rim, that portion which is exposed above the rim only acts as a cushion, while that portion which is in the concave part is simply dead, and will not expand, as it is held in confinement, unless the rim will yield." If he intended this statement should apply to the air within the rubber as well as to the rubber itself, then it may be stated that the fact is, that that portion of the air which is located at the back of the tire up against the solid unyielding rim is doing its full share of cushion work as thoroughly as the rest of the air in the tire.

But Mr. Bolte has gained an incorect idea of the rubber pneumatic cushion which I have invented. He says that he understands it "as an unyielding receptacle in which air is compressed to a certain measure, according to the weight to be carried." Then he goes on to say, "If the receptacle or cushion itself was made of expansive material, the case would be quite different, as air which is already compressed under the dead weight and cannot yield any more would stretch the bag or cushion, and thereby make it elastic, and no doubt be of some use for which it is intended."

As a matter of fact, the cushion is made of expansive material. In this regard the cushion and the purposes it accomplishes are well described in one section of my patent, which I quote here:

"In means for preventing vibrations in vehicles, a bearing plate, a supporting plate and a hollow distendable air cushion unconfined between them so placed that the air pressure at right angles to the line of shock may be free to cause the walls of said cushions to stretch and thus render the tensional resilience of said walls available."

It is thus seen that the pneumatic cushion accomplishes the very ends which he remarks are most desirable.

The principle of the invention and its practical application may be described as follows: Vibrations and shocks to which a vehicle is subjected in going over rough ground, are transmitted upward to the vehicle from the ground until they reach the pneumatic cushion. Then these cushions (which are a combination of air within an elastic and distendable cover) first receive the shocks and vibrations and then absorb and dissipate them in a surprising manner, at the same time supplying the greatest amount of ease and comfort to the occupants of the vehicle, and imparting to them a delightful sense of lightness, as if riding on air. The cushions do not need to be blown up hard, but only such amount of air is necessary as is sufficient under compression to distend the walls of the cushion in a lateral direction.

The cushions are calculated to carry any weight, and to give the full amount of comfort and ease through their resilient quality with varying loads. They will absorb shocks equally and will distribute the same amount of resiliency whether the vehicle be partially or fully loaded, while with steel springs, on the contrary, no such effect is possible. Steel springs must be made of such stiffness as to give the maximum of resiliency only with the greatest weight which the springs may be called upon to bear. For instance, suppose a wagon body weighs 200 lbs. and is of such size as to carry comfortably four passengers. The total weight then of wagon body with passengers will be 800 or 900 lbs. The steel springs must be of such strength and stiffness as to carry this weight safely and with comfort to the occupants of the vehicle. If, however, in the same vehicle there is but one passenger, the total weight of wagon body and passenger carried by the springs will be somewhere in the neighborhood of 350 or 400 lbs. It is clear that the steel springs which have been calculated for a weight of 900 lbs. are not most appropriate for a weight of less than one-half, nor will the single passenger under such conditions be in receipt of as large an amount of comfort from the springs as he would receive were the vehicle carrying its full quota of passengers.

Steel springs are not only heavy and costly, but are liable to fracture, when serious injury to the vehicle or its occupants may occur. Pneumatic cushions are lighter and less costly than springs, and a measure of safety is found in their use, for should a defective cushion be placed upon a vehicle and burst not the slightest ill effect would result. As the air escaped from the cushion the vehicle would be gradually and but slightly lowered at the point of location of the fractured cushion. The other cushions would then be called upon to supply an additional amount of resiliency equal to that lost by the defective cushion.

W. N. AMORY.

Differs from Mr. Bolte.

New York, Oct. 9.

Editor Horseless Age:

Your correspondent F. H. Bolte seems to have an erroneous conception of the action of a pneumatic tire. He says: "The rubber pneumatic cushion is an unyielding receptacle in which air is compressed to a certain measure, according to the weight it carries," etc. That statement contains its own refutation. If the air in the tire can be compressed by the weight put on the wheel, the tire cannot be an unyielding receptacle. I fancy Mr. Bolte wishes to say that the capacity of the receptacle does not increase—that is to say, it may be dented, but not bulged. Admitting for a moment that such is the case, it does not invalidate the fact that the air in the tire may be compressed still more by additional weight on the wheel. The limit to air compression is not reached in pneumatic tires.

The same fallacy is in the further statement: "If the receptacle or cushion itself was made of expansive material the case would be quite different, as air which is already compressed under the dead weight and *cannot yield any more* would stretch the bag or cushion and thereby make it elastic." (The italics are mine.) That is just the point. The air can be compressed a little when the tire is flattened at its point of contact with the ground, and it expands to its normal pressure when the weight is taken off. Such variations in loads on wheels are constantly going on while a vehicle is running. The ability of the air to submit to compression and instantly recover when the weight is removed is one of the most valuable features of the pneumatic tire. The normal air pressure in the tire is sufficient to restore the tire to its original shape when the cause of the change of shape is removed.

JAMES W. MANSON.

The Balanced Motor.

Bloomfield, N. J., Oct. 7.

Editor Horseless Age:

The subject of balanced reciprocating motors is a very interesting one just now, but it is also a very puzzling one, and the problem is, as Mr. Towle, in your Oct. 4 issue, says, "frequently not understood by gas engine experimenters." The problem is undoubtedly principally one of torque.

I believe these so-called balanced, two-piston opposed cylinder gas engines were first brought out in Germany, in a commercial way, about 10 years ago by Emil Capitaine, and were manufactured in sizes up to about 7 h.p. by Philip Swiderskie, of Leipsig.

These engines are being used to some extent, and almost exclusively in launches, and at a high speed they seem to run very steadily and without much vibration, but it should be noted that they are comparatively heavy.

Inspired by the smooth running and success of these small engines, a German engineer built a much larger one of about 60 b.h.p., and installed it in a large working boat, some 90 ft. in length and of great beam, and solid construction, being intended for fishing purposes on the Baltic. This engine was built upon exactly similar lines to the smaller ones, but of lower speed, and comparatively lighter in weight, but so far as smooth running goes it was a dead failure, and in the words of the inventor, "It shook the boat so that one could hardly keep one's feet when it was going."

I am of the opinion that Ernest M. White will have a similar experience with the motor described in your issue of Sept. 20, when he gets into larger sizes, and I venture to say that he will improve upon it by arranging his cylinders so that they work on one shaft, letting the explosions occur successively, and adding the metal contained in his large gears to that of his fly wheel.

VIGGO V. TORBENSEN.

Wanted—Bus to Carry 40.

Dhar, Central India, August, 1899.

Editor Horseless Age:

From what I have read and am reading in your valuable journal, I am convinced that it is possible for me to get a strong, reliable and economically working car, answering my purpose. But I don't know what firm can supply my want. I therefore give below the particulars of my requirement, and shall feel obliged by your kindly informing me the name of the firm you think most able to do the work.

I have to use the car on passenger service daily on a road which is ordinarily metalled. The particulars are as follows:

1. The car must carry 40 passengers and their luggage of 20 lbs. each.

2. Its speed per hour should be from 10 to 15 miles on level road.

3. It must be capable of running daily at least 70 to 75 miles with full load and without strain on the machinery.

4. The gradient on the road on which the car will have to run is at the highest 1 in 25, or 4 per cent. The carriage must go over these easily at the rate of 6 to 8 miles per hour.

5. During the rainy season the road is metalled two miles at a time. The car must run without strain over the metalling at the rate of 8 to 10 miles to the hour.

6. The machinery should be such as could be handled by an ordinary mechancial engineer.

7. The traction may be by steam or by motors. In the former case wood must be capable of being used as fuel. In the latter case there should be no vibration and smoke.

From this I hope you will have a tolerable idea of the kind of car I want.

Hoping to be excused for the trouble,

Yours faithfully,

SAKHARAM MARTAND.

Gas Engine Practice.

Detroit, Mich., Oct. 3.

Editor Horseless Age:

Thanks for your encouragement in my attempt to supply practical working formulas applicable to the gas engine. It seems to me that outside of the direct utility of such formulas, they should have a tendency to standardize gas engine practice, which is frequently little less than slovenly.

We must look largely to the "practical" man for escape from the present makeshift forms of gas engines; but as Prof. Perry eloquently observes in his recent book on engines, the tendency is for conservatism to run to ridiculous extremes. Practice without theory will remain hopelessly in the rut.

Sincerely yours,

E. J. STODDARD.

QUESTIONS AND ANSWERS.

At the request of many of our readers we have decided to open a department of questions and answers. We will endeavor to answer any detail question in practical engineering pertaining to motor vehicles.

Points About the De Dion Motor.

Waukegan, Ill., Sept. 25.

Editor Horseless Age:

1. My copy of the issue of Sept. 20 is a little indistinct on page 1. Is the cylinder diameter of the De Dion motor given at 2.19+ in.?

2. Is the gear of the above about 1 to 5 and the driving wheels about 26 in. diameter?

3. Is the area of the exhaust valve made 3 or 4 times the area of the exhaust pipe, to the end of promptness of relief?

4. With a compression of 60 or 70 lbs. is it not necessary to have 600 or 700 revolutions per minute to obtain 1½ h.p. actual from the little 3½ in. x 3½ in. motor mentioned on page 18?

1. My notes of De Dion motor (1¾ h.p.), latest type, are: Diameter, 66 mm. (2½ in.), and stroke, 70 mm. (2¾ in.).

2. Wheels, 26 in.; but I have the gears as 12 and 84 teeth respectively. This is 7 to 1, of course.

3. I think your idea good, but would add that the increased area means less lift necessary, and with the high speed employed may be easier on the cam in the end. The cam contact would be less noisy if inclination is less, and I have always put this down for the real reason.

4. Yes—600 to 800 r. p. m.

R. I. CLEGG.

Definition of the Word Hydrocarbon.

Editor Horseless Age:

Simply as a matter of information the writer would ask for a definition of the term hydrocarbon as used in connection with motors, etc.

This term is observed in connection with many different styles of motors, and I am not quite clear as to the exact meaning of the term. G. R. & CO.

[The term is now frequently used as a general classification of motors operated by the products of petroleum. Like many other popular words and phrases, convenience rather than scientific accuracy characterizes its use in the automobile industry, and at the present time the term is restricted to motors in which an explosive charge is utilized.—Ed.]

Size of a Steam Cylinder.

Ridgewood, N. J., Sept. 26.

Editor Horseless Age:

Please print in your valuable Horseless Age the correct size in inches for a cylinder of 4 h.p. intended for a high-speed upright steam engine, supposing the average steam pressure to be 175 lbs. per square inch, and greatly oblige, yours truly,

C. L. J.

The number of revolutions that the engine is required to make is an important factor in determining the size of cylinder, and as the speed is omitted from the question a general rule may help our friend to work out this and similar points in engine design for himself.

Multiply the mean effective pressure in pounds per square inch by twice the piston speed in feet and multiply the quotient by the square of the piston diameter in inches; then point off five places from the right. The answer will be the net horsepower, allowing about 16 per cent. for friction. A well proportioned upright steam engine now on the market has a cylinder 3½ x 4 on the 4 h.p. outfit. Let us assume that such an engine turns at 300 revolutions per minute at a mean effective pressure of 100 lbs. $300 \times 2 \times 4 \div 12 = 200$, and $100 \times 200 \times 2 \times 12.25 = 4.9$ h.p. R. I. C.

Storage Batteries—Contact or Jump Sparks.

Akron, O., Sept. 29.

Editor Horseless Age:

I am running a wagon which I have built, but have trouble with the ignition. I use a two-cell storage battery said to have 108 ampere hours, with vibrator and wipe spark. When the battery was first used it went very well, lasting about six weeks, since which I have been unable to get it well charged. I sent it to the makers to be charged, but it ran out in about a week. Is this a common failing, or should the recharge be equal to the first?

Which gives the best results, a wipe contact or jump spark?

G. G. C.

Your battery was probably exhausted to too low a point on its first discharge, and the recharging did not replace the loss. Have it recharged again, but do not discharge it beyond one-half its capacity, and then have it recharged thoroughly. If this is not effective in returning the battery to its original condition, it is probably defective and should be repaired.

Both the secondary and wiping sparks are good for the purpose designed. The wiping spark requires a mechanical movement in the cylinder head and is subjected to wear and corrosion. The induced spark requires an induction coil and great care in the insulation of the wires.

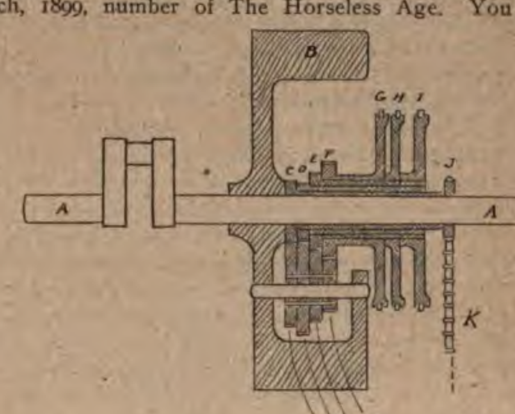
THEODORE D. BUNCE.

A Sun and Planet Transmission.

Redkey, Ind., Oct. 2.

Editor Horseless Age:

Inclosed find sketch of a sun and planet transmission gear, similar in some respects to the "Pretot mechanism" shown in March, 1899, number of The Horseless Age. You would



greatly oblige us by answering the following question: Would a motor vehicle transmission gear constructed on the general lines of the inclosed sketch infringe on Pretot or any one's patents?

With best wishes we beg to remain, yours truly,

JAMES RUNYEN & SON.

Recent Experiences With Steam on Common Roads.

J. I. Thornycroft, of the Steam Carriage & Wagon Co., Chiswick, England, delivered a paper under the above title before the British Association for the Advancement of Science at its recent meeting at Dover. A general résumé is appended:

He spoke of the limitations imposed by the Light Locomotive Act of 1896, restricting the weight of a motor vehicle unladen to less than three tons, as the chief impediment at present in the way of the manufacture of commercial steam vehicles. Loads of 5 to 10 tons had to be dealt with, and while it was possible by the free use of aluminum and expensive steels to construct a vehicle which should perform this work for a short period, yet durability would be lacking. French makers, he said, had found that a vehicle of 4 or 5 tons was required to carry a ton and a half of passengers. This, he thought, was rather high, though strain increased rapidly with speed. In Lancashire loads of 10 tons are hauled by horses at a rate of 2 miles an hour. This rate could be doubled at half the cost by steam vehicles.

A steam vehicle weighing 16½ tons with load should have front tires 5 in. wide and driving tires 7½ in. wide. Too much stress, he thought, could not be laid on durability. Unless vehicles were designed with generous proportions excessive wear and tear would take place.

The English law allows each light locomotive to haul one trailing vehicle, their joint tare not exceeding 4 tons; and it might be thought that this would permit the successful transport of heavy loads. Experience shows, however, that while this is the case, per se, manufacturers and merchants can rarely be found to view this method with favor, owing to the difficulty anticipated in manœuvring into and out of yards and wharves with a second vehicle; and their present attitude is strongly in favor of the whole load being borne by the motor vehicle alone.

Mr. Thornycroft then proceeded to describe the vehicles bearing his name. This description we present almost in full:

"To begin at the beginning, a light steam van was built in 1896, and designed to carry a useful load of 1 ton at a speed of from 8 to 12 miles per hour; the propelling machinery is in the fore part of the vehicle (the front wheels are the larger pair), and is chain-driven and front driving. The engines are a pair of small inverted vertical tandem compounds, having cylinders 2 in. and 4 in. in diameter by 3 in. stroke, and making about 500 revolutions per minute at a vehicle speed of 8 miles per hour. A machine-cut toothed pinion on the crank shaft engages with a spur wheel on a countershaft, which, in its turn, rotates the driving wheels through a pair of block chains driven by suitable sprockets. The countershaft carries the usual differential or 'Jack-in-the-box' gear to facilitate steering.

"The boiler is of the water tube type, in which the water tubes also form the fire bars, and was designed for a very light launch boiler; the tubes are of solid drawn steel ⅝ in. o. d.; the heating surface is about 50 sq. ft., and grate area about 2½ sq. ft. An air condenser is fitted on the roof of the van; this is constructed of a series of thin copper tubes, and weighs less than 200 lbs.; the cooling surface is about 130 sq. ft. Placed in this position, and concealed from view by the side boards, it occupies little room, and does not have the effect of making the vehicle appear bulky; under ordinary circumstances it condenses most of the exhaust steam from the engine. The safety valve discharges also into the condenser, which thus provides a silent and invisible blow-off; this is a point of some importance in steam vehicles plying in crowded thoroughfares.

"The air condenser, of course, gives no vacuum—indeed, there is no doubt but that it increases, and, if not suitably arranged, very greatly increases the back pressure of exhaust.

"The condensed steam also is very often so contaminated with grease from the engine as to be unfit for boiler use. It introduces the further disadvantage of increased cost, weight and complication, the latter both by reason of its own construction and of the additional piping and connections involved. It is doubtful whether these demerits do not more than outweigh the two nominal advantages its use confers, namely, less deposit of line in the boiler and the necessity of carrying a small feed tank only. There is the further and undoubted advantage of hot feed, but this is simply obtained otherwise by constructing the exhaust silencing vessel as a feed heater.

"The condensed water drains from the condenser into a hotwell, and is thence redelivered to the boiler by a feed pump driven from the engine shaft. To prevent any accumulation of pressure in the condenser from accidental causes, communication with the funnel is preserved through a connecting pipe.

"In roofless vehicles it is difficult to arrange for an effective air condenser. Experiments have shown that a plain copper tube, while possessing ample receptive area, lacks radiating surface; this defect may be largely overcome by the addition

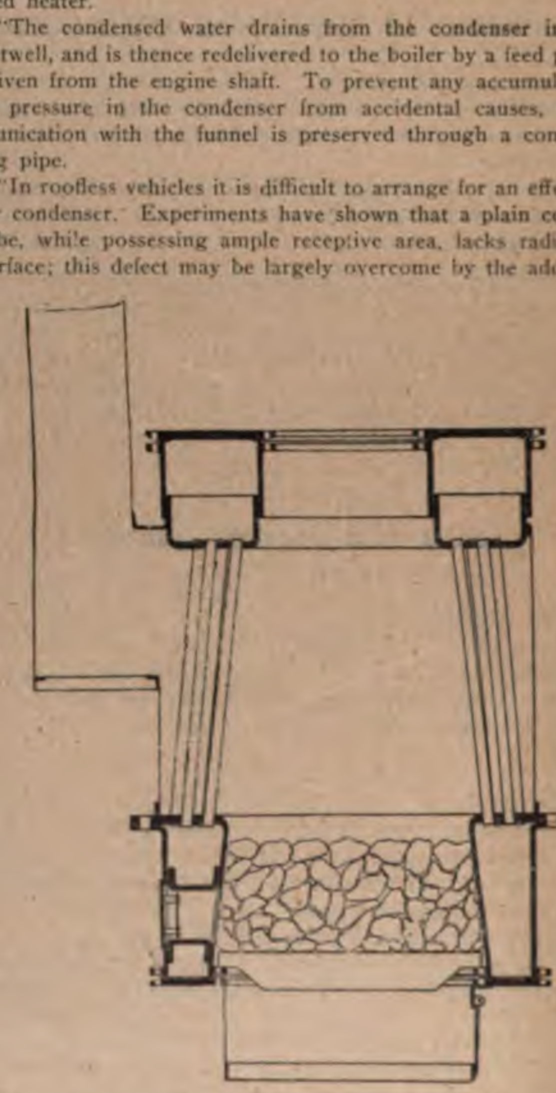


FIG. 3. SECTION OF THE LATEST PATTERN THORNYCROFT BOILER WITH DEEP BOTTOM WATER RING, SO THAT THE IGNITED FUEL IS KEPT FROM ACTUAL CONTACT WITH THE BOTTOM OF THE WATER TUBES.

of external radiating gills to the tubes, so disposed as to present a very short free path to the air currents traversing them. Such an air condenser must be cooled by a fan driven from the engine, and can be made lighter and more compact than if formed of plain tubes; this fan will absorb about 12 per cent. of the whole engine power, and forms a further complication in the design.

"The weight of the van, unladen, is about 3,000 lbs., and a load of 1 ton is successfully dealt with at a speed of about 10 miles an hour along ordinary roads; though fitted with single-speed gear only the van can mount hills of 1 in 13 on macadam surfaces. Rear steering has not been found convenient, and all later designs have front steering arrangements.

"The two tip wagons or dust carts supplied about two years ago to the Chiswick Vestry have been in continuous daily service since delivery, and are often used on Sundays also for the collection of road scrapings. The tipping bodies have a carrying capacity of 6 cu. yds., which, in dust-bin refuse, weighs 3 to 4 tons. At Chiswick about 22 cu. yds. of material are dealt with per vehicle day. With men working piece work, about 30 cu. yds. per day are collected.

"The boiler has heating surface of 65 sq. ft.; grate area of 2½ sq. ft., and a gauge working pressure of 175 lbs. per square inch; it is of similar type to that of the 1-ton van already described. The engine, however, is in this case, attached beneath the under frame, and is a horizontal compound, having cylinders 3 in. and 5 in. in diameter by 5 in. stroke. The cranks are at 180 deg., and the cylinders are on opposite sides of the crank shaft to permit easy running at high speeds. The frame, guides, valves, pistons and piston rods are of bronze, to prevent the engine rusting up when standing.

"The engine is thrown in and out of gear with a shaft co-axial with its own by means of a friction clutch; this latter shaft carries a toothed pinion engaging with a spur wheel on the countershaft, the remainder of the transmission being similar to that of the light van already described. Renolds' 'silent' chains are, however, used for the final drive instead of block chains, as in the light van.

"These vehicles are front steering, the method adopted being that of the 'divided axle.' The arrangement provides for the turning of the leading wheels, so as to satisfy the condition that their axes of rotation produced intersect on that of the rear axle; by this provision, and differential motion of the rear wheels, perfect facility in steering is attained.

"An air condenser is carried on the roof as described in the first van; the area of cooling surface is 145 sq. ft., and the weight about 225 lbs.

"In a tip wagon of later design the tipping body is of high grade steel of the quality used in the construction of torpedo boats; it was feared that this would prove noisy in running, but this was found not to be the case.

"The water tube boiler has a heating surface of 65 sq. ft., grate area of 2½ sq. ft., and is here of annular type, as shown in the figure. An induced draft is created by means of a fan in the uptake, through which all the products of combustion pass; on first lighting the fan is hand-driven, and in this way steam can be raised very quickly.

"The engine is horizontal compound, having cylinders 4 in. and 7 in. in diameter and 5 in. stroke, placed beneath the under frame; the working parts are completely encased, and the "oil bath" or "splash about" method of lubrication is adopted. The transmission is effected similarly to that of the Chiswick dust carts.

"This vehicle, with full load, maintains an average speed on ordinary roads of from 6 to 6½ miles an hour; at the higher of these two speeds the engine makes 500 revolutions per minute.

"In this wagon is found the first practical recognition of the advantage of separating the whole vehicle into a motor part and a carrying part; it will be noticed rearward of the driver's seat (or cab in this case) the upper surface of the under frame is left absolutely clear for the attachment of any type of after body desired. The vehicle has, in fact, done daily work for the Camberwell, Chelsea, Leyton and Chiswick vestries as a tip wagon and as a wagon for the carriage of goods and material in Liverpool, Birmingham and in the London district.

"The extreme length of the motor part is only 12¾ ft., breadth 6½ ft. and height 10 ft.

"The wheels shown in the illustration were wholly of steel, and of a light and elegant design, fitted with plain roller bearings; they were built by a Midland firm, and the workmanship left much to be desired. Due largely to this, and partly, perhaps, to the wheels being somewhat light for their load, they proved to have but a short working life; and on the terrible cobbles in the neighborhood of Liverpool they were found wholly unsuitable, showing unmistakable signs of collapse after only two or three days' use.

"They were replaced by a pair of steel disk wheels, a feature of which is the divided false tire put on over the tire proper. The road impact in these heavy vehicles always causes a marked lateral and circumferential flow of the tire metal; this can be met by making broad and thick tires of tough metal; in this case it has been done by affixing to a light tire an outer tire composed of a number of oblique-ended pieces with short gaps left between each pair; this gap gradually disappears in service, due to the creep of the metal; when worn out these may be replaced without sacrificing the tire beneath.

"The steel disk wheel is, however, though very satisfactory in service, a rather heavy construction, and in later vehicles the wheels are of wood; metal naves, stout oaken spokes, ash felloes, wide and thick tires of rough metal hydraulically squeezed on; and the adoption of a method of driving the wheel from the felloe, leaving the spokes in much the same condition of service as in the horse-drawn vehicles, forms a combination which has practially overcome the driving wheel difficulty in these heavily loaded wagons.

"My first passenger carriage was largely an experiment, and is fitted with a method of transmission essentially different from that of any of the preceding vehicles.

"The engine and boiler are carried in the after part; the products of combustion are conducted downward through a trunk and discharged directly rearward.

"An air condenser with radiating gills and air circulating fan (visible in the figure) is fitted in the box in the fore part of carriage. The wheels have solid rubber tires 3 in. wide in metal rims.

"The transmission is effected in the following manner: A flanged pulley on the engine shaft drives a pair of equal pulleys on the countershaft through a link belt, each of the pair taking one-half the belt width in straight ahead running; the countershaft is in two parts placed co-axially, these parts being repectively driven by the two equal pulleys just mentioned, and carrying at their outer ends sprockets communicating motion to the driving wheels through the medium of chains; the engine is thrown into gear by a belt-tightening jockey pulley operated by the driver.

"By the adoption of the device of a pair of pulleys sharing the driving belt between them, it is possible to dipense with the expensive 'Jack-in-the-box' differential gear, and so far as my experiments have proceeded there seems promise of success. The intended action is as follows: On turning a corner the outer driving wheel revolves more quickly than the inner; the belt automatically shifts toward the more quickly moving pulley, and the correct differential motion of the wheels is thus not only permitted, but directly aided, in this way; as a matter of experience, the carriage is found to respond to the steering wheel with the greatest readiness.

"The carriage in the illustration has maintained a speed of 16 miles per hour with ease, carrying half a dozen passengers.

"A 3-ton dray, built for a firm of brewers, and which commenced running late last December, hauls a further 2 tons on a second vehicle, and easily maintains a speed of 5 miles an hour; on several occasions loads of rather more than 6 tons have been transported nearly 6 miles an hour. Its owners consider that it replaces three two-horse drays; the daily journey averages 30 miles. The total mileage to the present date is roundly 5,000.

"The conditions here favor the economical employment of heavy motor vehicles; the brewery supplies its various depots situated at distances of from 14 to 20 miles; there is thus regular, full load, long journey work, and the return runs are made with from 25 to 50 per cent. of load in empties; the cost of running, inclusive of all charges for interest, depreciation, wages, fuel, repairs and stores is, roundly 3d. per net ton mile, or 0.6d. per barrel (36 gallons) per mile.

"It will be noted that the boiler and all mountings are now placed in front of the driver, but in such manner as not to obstruct his view ahead; the driver is seated on a transverse tank containing part of the feed water, the remainder of which is carried by a tank at the rear end of the under frame.

"The pressure and water gauges, sentinel valve, check valves and fire are in full view; and all the operations of steering, reversing, braking, engine regulating, firing, and, in short, of completely controlling the vehicle, are performed from this seat.

The bunkers are placed on each side of the boiler in the extreme front of the vehicle, and carry fuel for a 40 to 50 mile run; so placed the fuel is always to hand, and some protection is afforded the boiler in case of collision.

"As will be inferred, the vehicle can be completely controlled by one man; owners generally find it convenient for their own purposes to carry a lad, but this is not absolutely necessary. The extreme dimensions are: Length 17½ ft., breadth 6½ ft., and height 9½ ft. The carrying body is of 12 cu. yds. capacity, and has been made large to accommodate a good load of 'empties' on homeward runs.

"The boiler is of the annular water tube type, with slightly inclined straight tubes, and fire contained in the bottom vessel so as to preserve the tubes from actual contact with the ignited fuel.

"The engine is of similar design to that of the steel tip wagon already described; there is no air condenser, the exhaust steam from the engine being passed through a simple form of feed heater, forming also an exhaust silencer when any contained moisture is drained off; thence it passes to a blast nozzle placed at the base of the funnel; in this way the exhaust is discharged noiselessly and invisibly.

"A small feed pump, chain-driven from the engine, supplies the boiler while the vehicle is running; and an independent donkey pump is supplied for feeding when standing, and as a reserve.

"Economy of water is of considerable importance in these vehicles, and the use of superheated steam no doubt effects an economy in this respect; but this economy is likely to be gained at the expense of considerable wear and tear of the engine. A more serious doubt exists as to the safety of these small superheaters, which are necessarily often at an exceedingly high temperature, and subjected to severe vibration. This vehicle was at first fitted with a superheater placed in the combustion chamber, but after three months' service it was removed, on account mainly of the consequent engine trouble. So far as could be judged from results in ordinary daily service, very little increase in the water consumption appeared to result from its removal.

"The exhaust steam feed heater appears a useful adjunct, as it both reduces fuel consumption and causes the boiler to supply drier steam; its use involves no risk and very little increase in weight or cost.

"Water for a full load run of 15 to 20 miles is carried by this dray.

"In all the preceding vehicles the final drive was effected by chains. The great difficulty in all self-propelled road vehicles has always been to provide a continuous driving effort without impeding free and independent play of the bearing springs.

"A chain, being a flexible connector, has enabled the difficulty to be overcome, but, so far, not in an altogether satisfactory way. It is found that unless made exceedingly large and effectually encased and lubricated, their life is very short, and the replacement of worn-out driving chains is an important item in the up-keep cost; however, a very large number of vehicles, both heavy and light, are still chain driven.

"Traction engine makers have long abandoned pitch chains in favor of tooth gearing for driving purposes, and in some cases have adopted wheels with unusually long teeth, and, in others, a modification of the well-known Oldham coupling, to permit the small amount of play (half an inch or so) they allow the springs in their vehicles; others, again, have resorted to bevel gears and telescopic shafts to attain the same end.

"In one lorry a method of chainless transmission has been adopted which is, I believe, unlike anything previously used in this country, and the essential features of which may be thus described: The countershaft is in three distinct pieces; the first of these is attached to the channel steel under frame, and is driven by the engine through a toothed gear; the third is borne in bearings carried by a bracket supported upon an angle-steel frame connecting the front and rear axles, and termed the 'perch frame'; this third part carries a stout toothed pinion gearing with the spur ring of the differential gear, which is here borne by the rear axle.

"These two pieces are connected by a third or 'intermediate link,' by means of a pair of specially designed universal joints, one of which permits also of a transverse sliding motion taking place; these are so made as to provide large bearing surfaces, to insure durability, and, being wholly inclosed, are dust-proof and oil-retaining.

"Between the extremes of no load and a 'bump' with full load there is a vertical motion of the under frame relatively to the perch frame of 6 in. or 7 in., and this is taken up perfectly by this means, without interference with the continuous torque exerted on the driving wheels, and without bringing any strain upon the frame or mechanism.

"The rear axle turns and is carried in axle boxes somewhat of locomotive type, attached to the under side of a pair of laminated bearing springs; the rear wheels are driven from the felloes by a pair of springs attached to the main axle at the off side and to the sleeve of the differential gear at the near side, pressing against suitable projections from the felloes; by this means the driving wheel sopkes are relieved of the driving effort, and a yielding connection is obtained between the road wheels and the driving mechanism.

"The legal limit of speed is, at present, 5 miles an hour for the heavier class of self-propelled vehicle; the type shown in Fig. 6 is easily capable of maintaining a speed, with a full load, of 6 or 7 miles an hour. In fact, in the competition organized by the Self-Propelled Traffic Association early last month, one of these, described as a 'standard 3-ton steam wagon, capable of hauling a further 2 tons under ordinary circumstances,' transported a load of 6½ tons about 36 miles daily, at a running speed of over 6 miles per hour, and mounted gradients with this load of the unusual steepness of 1 in 9 at Liverpool.

"For general use on ordinary roads the steam engine gives sufficient range of power without the use of any variable speed gear, and this range is greatest when, as in the present instance, a valve gear permitting of a 'linking up' is adopted. My latest vehicles have a compact, constant lead gear permitting any degree of expansive working, and this is found to result in a decided economy in water consumption.

In most cases, however, it is desirable, and even necessary, to provide a means of considerably increasing the turning effort on the driving wheels in order that soft roads may be successfully traversed, or very stiff gradients climbed; for such contingencies a low-speed gear is fitted, enabling a turning effort 75 per cent. greater than the normal to be exerted. The change speed gear adopted also provides for both the driving pinions on the engine shaft being placed out of gear at the same time, the engines then being capable of running freely with the vehicle standing; this permits the engine to be employed for the driving of stationary machinery if required, and also enables the vehicle to be easily moved when steam is not up.

"The leading features of my most recent vehicles are briefly then as follows:

"The whole motor part, with the exception of the wheels, is of metal, steel predominating. I regret to have to add that aluminum freely enters into the construction at present, for a reason already dwelt upon. No chains are used, the method of driving already described being adhered to.

"The water tube boiler has straight, slightly inclined tubes, fired from the top, and the fire cleaned through a special door at the bottom (see Fig. 3).

"The engine is wholly inclosed, with oil-bath lubrication, but is so arranged that easy and complete access to all parts can be readily gained; adjustment is required about once in three months; a constant-lead radial valve gear is fitted, having large bearing surfaces and driving piston valves. The engine is suspended from the under frame from three points in such manner as to be relieved from all strain due to 'winding' of the underframe when running; the feed pump is directly driven by the engine, and the valve box so arranged that the valves are instantly accessible; the auxiliary feed is by a self-starting injector, so designed to enable the cones to be withdrawn while the boiler is under steam.

"Two-speed gear is fitted as already described; a worm-driven steering gear is adopted allowing free play to the front bearing springs, and having all steering strains self-contained.

"The motor part permits any type of carrying body being attached, so that one vehicle can be used in a variety of services. Durability, simplicity, economy and centralization of control are the main features in the latest vehicles of my design.

"Welsh coal is used as fuel, though coke, oil, or inferior fuels can also be burned; used intelligently, Welsh coal causes no smoke nuisance whatever, burns noiselessly, and is not difficult to obtain. Oil is considerably more costly, is not everywhere procurable in sufficient quantity, and is often noisy in burning, and liable to leave an offensive odor in the track of the vehicle.

"Care should be exercised in the selection of the driver, as the success of the vehicle depends in a considerable degree upon his care and intelligence; he should understand all the details of construction of his vehicle, and be able to deal with any small defect that may arise while on a journey, and of making adjustments and executing small repairs to the mechanism when in the shed. For the farrier's forge there must be substituted a primitive repairing shop fitted with a few simple tools and spare parts to enable this to be done expeditiously.

"I will conclude by inviting your attention to the table, which embodies some results recently obtained with heavy steam vehicles both in this country and in France. The figures for the 'Ravee' have been introduced to enable a comparison to be made between present-day practice with light locomotives and the heavy road engines built some years ago for service in the Punjab. The 'Ravee' figures were obtained by Mr. R. E. Crompton from the celebrated journey from Ipswich to Edinburgh and back, a total distance of 805 miles; the figures for the other vehicles are almost wholly compiled from official accounts of trials. It will be seen that the palm for minimum water per gross ton mile remains at present with the De Dion vehicle, a result due mainly to the very considerable amount of superheat employed in these vehicles. The importance of fuel consumption is often overestimated; this item of expense constitutes not more than 10 per cent. of the total running cost.

"The problem of the light locomotive I believe to be already solved in all its main features; a more extended experience will, of course, suggest many improvements in details. It will be necessary to carry heavier loads than are at present practicable, and this will become possible simultaneously with the removal or amendment of the existing restrictions as to tare weights."

THE VOITURETTE COCHOT.

OUR FOREIGN EXCHANGES.

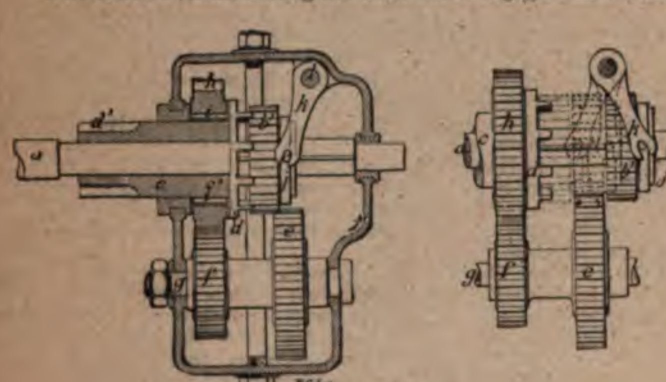
Speed-Changing Mechanism of Petitjean & Sevette.

La France Automobile gives a detailed description of the speed-changing mechanism of Petitjean & Sevette, which was shown this summer at the Tuileries.

The mechanism works only when a slow, hill-climbing speed is desired. It consists of a train of reducing gears, with this peculiarity, that while always in mesh with the pinion commanding the countershaft, it communicates motion to that shaft only when the low sped is thrown in. Fig. 338 shows the mechanism at the moment of passing from the high to the low speed or the reverse. Fig. 338 shows three positions: Gearing for high speed, low speed and complete disconnection.

Upon the motor shaft a is a clutch, f, sliding along this shaft and revolving with it. In the high speed it engages directly with the hollow shaft c, mounted idle upon the shaft a. The toothed part of the coupling box f' is brought into engagement with the toothed wheel d, solid with the shaft c. This shaft has a toothed part, d', meshing with the large pinion of the differential.

In the low speed motion is transmitted to the hollow shaft c by means of reducing gears and a special clutching device. The clutch b', shifted along the shaft out of engagement with the



pinion d of the hollow shaft c, rotates the latter by means of reducing gears e, f, in one piece and revolving on the shaft g, the wheel engaging with the coupling b and the wheel f with the pinion h, which turns a rack c', cut in the hollow shaft c. In the spaces between the inner rim of this pinion and the rack teeth are friction rollers, i, intended to come into play when the pinion is moved in the direction the motor is turning.

The clutch b' is shifted by means of a fork, k, fixed to a shaft, l, operated by a lever. To shift from high to low speed the lever is moved, bringing the toothed part of the clutch into engagement with the gear l; thus in the passage from high to low speed the clutch f' is for an instant in mesh with both the teeth of the pinion d, fixed to the hollow shaft c, and the teeth of the wheel e, but owing to the arrangement of the rollers and the direction of rotation, there is complete separation of the shaft and the gear h, so that the speed of the shaft is equal to that of the motor shaft. On the other hand, when the teeth of the clutch b leave those of the hollow shaft c the speed of the latter decreases until it equals that of the pinion h. At this moment the pulleys i wedge together and the pinion h moves the gear c' and consequently the hollow shaft c.

Consequently the low speed is always thrown in before the high speed is thrown out, and becomes operative only when the motor has reached the speed, thus avoiding stripping of teeth.

To pass from the low to the high speed it is only necessary to move the coupling box b in the opposite direction to bring it into engagement with the pinion d.

To facilitate this it is well to switch off the ignition for a moment.

The throwing-in clutch can also be moved along the shaft a past the wheel e so that complete disengagement may be obtained and it may remain in place without stopping the motor.

This speed-changing device therefore possesses the following advantages:

1. It is all inclosed, runs in oil, and the parts are made of tempered steel.

2. The high speed is obtained direct from the motor shaft to the large gear of the differential. At this no other part is involved.

3. The low speed is obtained by means of a gear commanded directly by a pinion sliding along the motor shaft. This gear transmits the motion to the pinion which controls the large gear of the differential through a strong clutch or ratchet wheel.

4. The change of speed is accomplished without noise, shock or possibility of mistake by means of a single lever, which can be moved as slow or fast as desired.

The advantage of this arrangement is that in changing the two speeds are simultaneously in gear, so that when the gearing in for the high speed ceases action that of the low speed commences to act after having left the motor to take its normal speed. Thus overloading of the motor is prevented when changing speed.

5. The vehicle may be stopped without stopping the motor.

The Peugeot Carbureter.

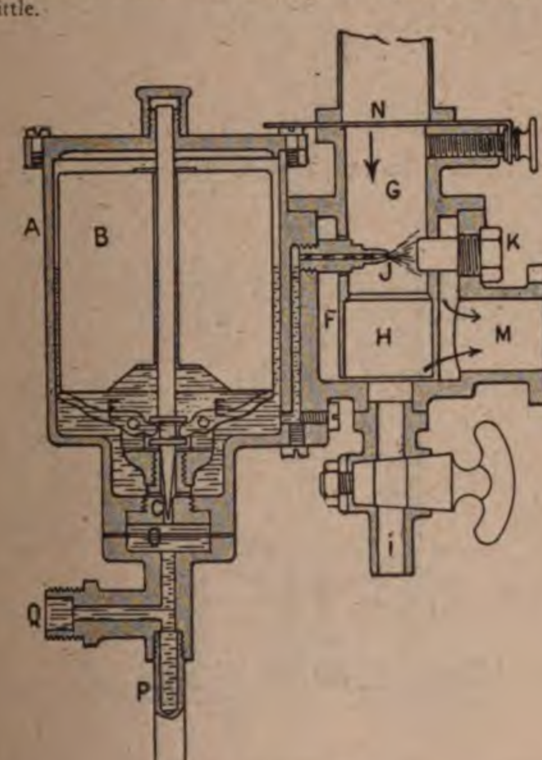
La France Automobile gives a description of the Peugeot carbureter.

At the gasoline tank is a valve which can be closed if desired, preventing the flow of liquid to the carbureter when the vehicle is not in use or when the carbureter is being repaired.

The tube conveying the liquid to the carbureter is fastened by a screw at L. The liquid reaches the carbureter in the following manner: The lower end of the tube K serves as a waste tap in case the carbureter has become clogged because of long disuse. This mouth is of course provided with a cap. The gasoline comes in at Q and descends to the purifier P, but in the carbureter tends again to take the level it had in the reservoir, which is always placed higher. As it enters the carbureter a gauze prevents the passage of any impurities it may hold. The liquid then passes through the orifice and partially fills the reservoir A. When the liquid reaches a predetermined level in the reservoir the float B no longer rests upon the two small articulated arms E, and the plunger, by its own weight, closes the orifice and prevents the entrance of the gasoline.

EXTERIOR VIEW.

When, in consequence of the working of the motor, the level falls in the reservoir A, the float B will press upon the large branches of the arms E and slightly raise the plunger C, renewing the supply. The float and the plunger must not fail to act. If the latter is too hard the feed will be stopped; if the arms become wedged and do not yield to the float the carbureter becomes smutty. In either case the motor stops. To prevent these accidents it is necessary occasionally to take out the plug which stops the end of the plunger rod and either turn it a little with the fingers or play it up and down a little.



PLAN VIEW.

We will now suppose the carbureter reservoir is filled with liquid up to the proper level, almost equal to that of the horizontal flux J, by which the liquid is injected when the motor exhausts. The liquid does not attain this level of itself, for it would then overflow continually into the mixing chamber, which ought to be closed against gas only, not against liquid.

In the face of the orifice J is located a plug on which at the moment of intake the gasoline is projected, and is dissipated into fine spray.

The air feed is accomplished above at N. The air comes in through a tube passing under the burners, or, if electric ignition is used, around one of the exhaust pipes (see A, Fig. 2).

The inspiration of the motor, at the same time as it causes the inflow of gasoline, produces a rush of air into the tube G, the air crossing the gasoline vapor. The quantity of air drawn in, which varies from many causes, is regulated by means of a small screw controlling a movable diaphragm, N. This can be done from the seat and without stopping the vehicle through a switch-rod and handle.

The air and vapor mixed in this manner descend to the bottom of the socket H to be more perfectly mixed, whence the mixture passes into the carbureting chamber F and thence into the cylinder through M. In the circular chamber F the motor receives a charge. We have already spoken of the tube through which the air goes to be heated by the burners. The temperature of this air can be varied greatly by the operator. The tube has at each end a valve. That at the left, b, allows to pass a column of air which before going to the carbureter becomes heated. That on the right (not shown) allows a column of air to pass which goes direct to the carbureter without any reheating. By regulating one or both of these valves hot, cold or tempered air is obtained, as may be necessary for carburetion. To start the motor, particularly in winter, the cold air is generally cut off, and only warm air admitted, regulating the temperature after motor is in operation. If the carbureter does not perform its work satisfactorily then more fresh air is admitted at the moment when the mixture penetrates into the cylinders, by turning the valve I more or less to secure the proper temperature.

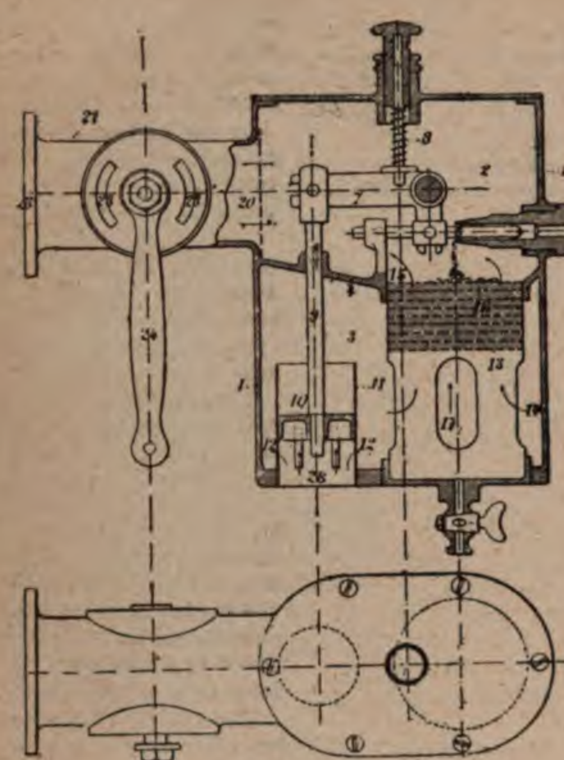
Two New Carbureters.

A novel form of carbureter has recently been tried in France with, we understand, successful results, says the Automotor. It is the invention of MM. De Sales and Braly. The principle adopted is to cause air to traverse fabrics saturated with the hydrocarbon, so that the air takes up the latter, and a saturated vapor, consisting of air and finely divided petrol, is produced which behaves as a gas—that is, there will be no subsequent condensation. Such a gas may then be mixed in any desired proportion. The carbureter consists of a chamber, 1, of suitable shape and size, divided into two compartments, 2 and 3, by means of a partition, 4.

The compartment 2 has inlets for the hydrocarbon, which flows from any closed reservoir in state of rest past an obturator, 6 (needle valve or the like), which may be opened by a set of suitable levers, 7, against a spring, 8.

This lever is actuated by the rod 9 of a piston, 10, which moves by atmospheric pressure in consequence of the vacuum formed in the box 1 by the suction of the motor.

The compartment 3 contains the piston 10 before mentioned, which slides with small friction in a cylinder, 11, having openings, 12, closed by the piston when at rest and uncovered



DE SALES AND BRALY'S CARBURETER.

when it is raised by the atmospheric pressure. The air sucked in penetrates into a cylinder, 13, pierced with holes, 14. The upper portion of this cylinder is provided with alternate layers of metal gauze and some spongy fabric, such as felt, linen, asbestos, spun glass, or the like, 15, 16. The metal gauze or perforated sheets have for their object to prevent subsidence which would cause the resistance to alter by use. The whole forms a cushion to which the density required for obtaining the desired degree of carburation is given.

The chamber 2 communicates by an opening, 20, with a pipe, 21, to which fresh air is admitted through a valve, the openings, 23, of which determine the amount of obstruction or regulation by the movement of a button or of a lever, 24.

The fresh and the saturated air are mixed together by any of the various methods in use.

The apparatus works as follows:

The suction of the motor causes a partial vacuum in the box 1, atmospheric pressure raises the piston 10, air passes in by the holes 12 into the compartment 3, penetrates by the openings 14 into the box 13, traverses the fabric 16, impregnated with hydrocarbon, becomes saturated and passes into the pipe 21, where it becomes mixed with the required quantity of fresh air, the latter being admitted through the holes 23 in the valve.

The piston 10, on rising, actuates the lever 7, through the rod 9, which allows a dose of hydrocarbon to escape past the needle 6 and flow into the fabric 16, which is thus at each aspiration impregnated with the quantity of hydrocarbon necessary to carburet the air.

The advantages of this apparatus are as follows:

It is claimed for this carbureter that it carburets the air to saturation in such a manner as to prepare a homogeneous mixture which may be treated as a gas.

The explosive mixture is formed outside the cylinder in a very restricted space only.

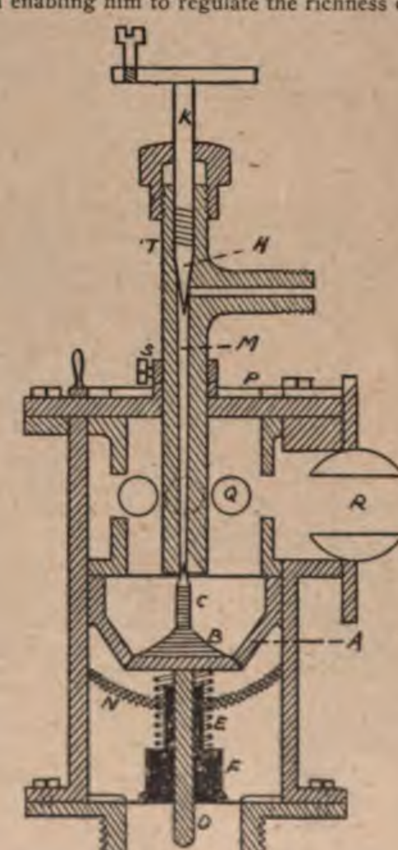
The admission of the hydrocarbon is regulated by the requirements of the motor itself by doeses determined in such a manner as to completely utilize it to the last drop, thus preventing waste.

Regulation is reduced to the introduction of fresh air—that is to say, to the movement of the lever 24.

The delivery of the hydrocarbon is proportional to the quantity of air to be carbureted, by the simultaneous action of the piston and the needle, and the standard of the hydrocarbon remains constant, for it is not vaporized in proportion to its entrance into the apparatus.

The Kellett carbureter has been designed to supersede those in which a float is employed. The inside of the carbureter is divided into two chambers by a diaphragm, A, which is pierced by a circular aperture fitted with a valve, B. This main automatic inlet valve B is provided with an upward extension, C, terminating in a needle point closing the inlet of liquid fuel, and a downward projection, D, engaging with a helical spring, E, to hold the valve up to its seating. The valve is guided by a portion of the carbureter framing, F. The tension of the spring E regulates the desired "lift" of the valve.

The supply of liquid fuel is regulated by the needle valve H, which forms the extremity of a rod, K. This rod carries a quick-thread screw, which, by a slight movement, can be turned to regulate the supply of liquid fuel to the tube M. The motion of the screw can be obtained by an arrangement of levers actuated by a handle placed conveniently for the driver, and enabling him to regulate the richness of the charge



Sectional Elevation.

KELLETT CARBURETER.

and therefore the speed and force of the engine. Upon the suction or outward stroke of the piston the inlet valve B, which admits air, is opened simultaneously with the needle valve C, which admits fuel. A jet of oil or other liquid fuel passes through the tube M and strikes against the ribbed cone or body of the valve B, C, and it is thus broken up into fine spray. At the same moment a current of air (of any desired temperature, as will be subsequently explained) rushes into the upper chamber of the carbureter, impinges upon the ribbed cone, and hastens the vaporization and admixture of the liquid fuel. The diaphragm of wire gauze, N, or other suitable material, which crosses the second chamber of the carbureter, serves the double purposes of completing the process of ad-[illegible]ture and of preventing any back firing from the cylinder, to which the explosive charge now passes. At the commencement of the return stroke of the piston the valves B and C are instantly closed, thus automatically cutting off both the fuel and air supplies. On completion of the return stroke the charge is in a suitable condition for firing.

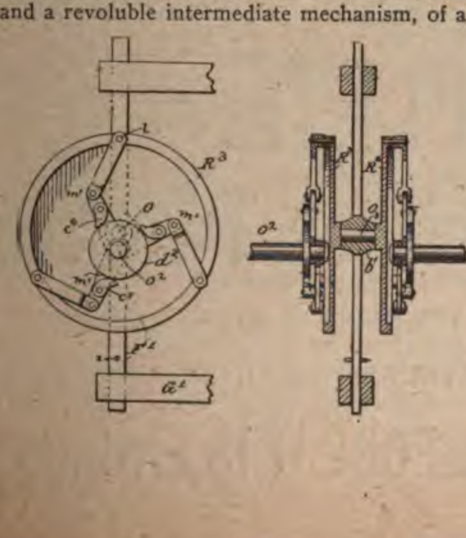
A baffle plate, P, communicating with the jacket of the upper chamber of the carbureter—through the holes G—with the upper chamber itself, enables a supply of cold air to be admitted. If desired this supply may be the sole source, but should it be wished to raise the temperature of the air for the purpose of effecting a more thorough varopization of the liquid fuel, or to raise the temparture of the charge to about the heat of combustion, a channel, R, is provided fitted with a baffle plate and communicating with any suitable source of heated air. By the manipulation of the two baffle plates P and R any desired temperature may be obtained.

MOTOR VEHICLE PATENTS of the world

No. 634,292—Clutch for Motor Vehicles.—William E. Gibbs, Fanwood, N. J., assignor to the Pneumatic Carriage Company, New York, N. Y. Filed Feb. 8, 1899. Serial No. 704,905. (No model.)

No. 634,327—Variable Power Transmitter.—Ludwig M. Dieterich, Hartford, Conn., assignor to the Dieterich Gear Co., New York, N. Y. Filed April 26, 1899. Serial No. 714,-473. (No model.)

Claim.—The combination, with a revoluble driving mechanism, and a revoluble intermediate mechanism, of a plurality



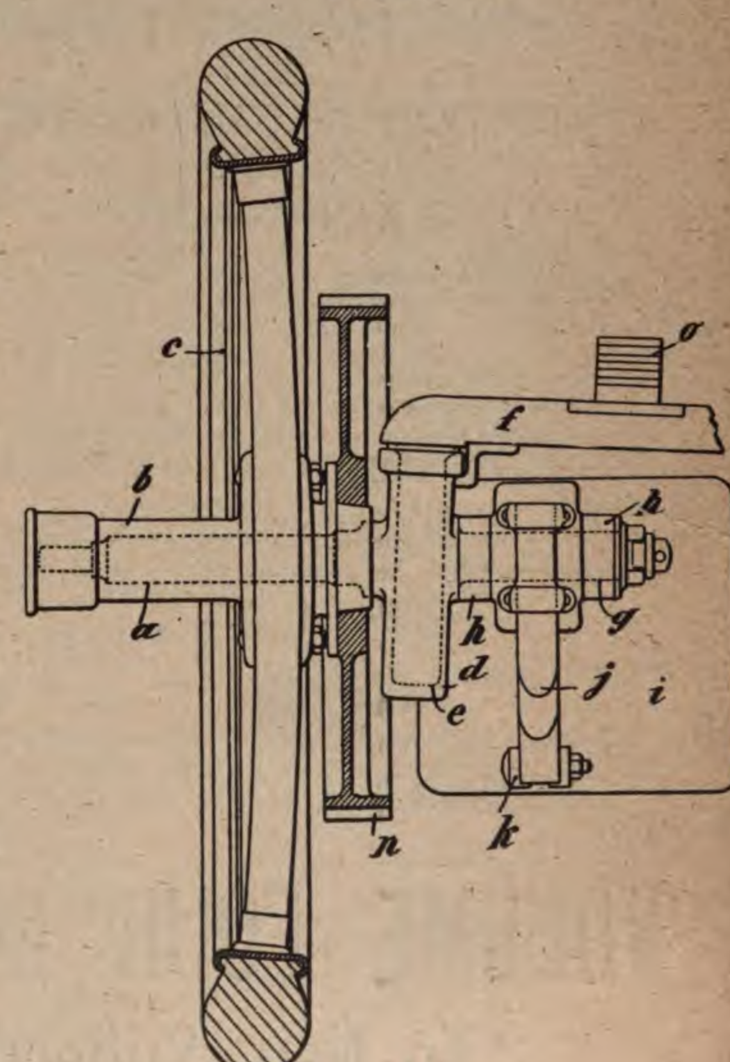
of transmitting devices connected to the said revoluble intermediate mechanism, detachable connections between the transmitting devices and the driving mechanism, means for permitting the alteration of the relative positions of the axes of revolution of the power-supplying mechanism and the intermediate mechanism, and a driven mechanism operated by the intermediate mechanism.

No. 634,067—Self-Propelling Vehicle.—Reuben H. Plass, New York, N. Y., assignor to Isabella C. Plass, same place. Filed Jan. 9, 1899. Serial No. 701,641. (No model.)

No. 633763—Motor Vehicle.—Louis Krieger, Paris, France. Application filed Aug. 1, 1899.

Claim.—An electro motor mounted on a false or supplementary axle arranged as a prolongation of the wheel axle of a vehicle and connected with the said false or supplementary

FIG.1.



axle by means of a spring, so that the said motor is capable of angular movement about the axis, which carries it when differences of effort are produced on the gearing, and is protected against shocks or jars, substantially as hereinbefore described with reference to the accompanying drawings, and for the purposes specified.

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

FOR SALE.

A Haynes-Apperson two-seated surrey, with canopy top. Run about 100 miles and in good condition.

A. B. GARDNER,
Dowagiac, Mich.

LOCOMOBILE WANTED.

At once, new or second hand, for spot cash. Address, giving price and date of purchase. B., care HORSELESS AGE.

PARTS FOR AUTOMOBILES TO ORDER.

OTTO KONIGSLOW

45 MICHIGAN ST. - - - - CLEVELAND, O.

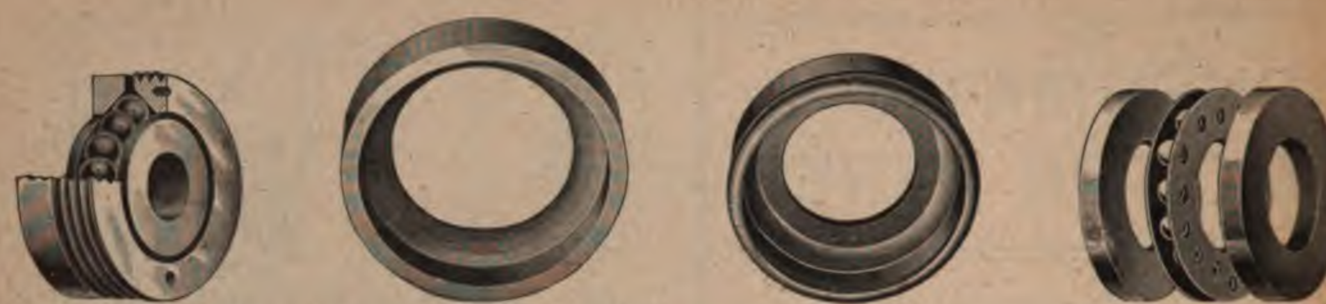
FOR SALE. 1 Motor Wagon Gearing including 2 speed, friction transmission device; 2 sprocket wheels, chain, brass boxes, reaches all ironed, etc. Track, 4 feet. Wood wheels, 36 in. rear, 34 in. front. 3 Elliptical springs. Front axle stationary and complete steering device. 3 H. P. Gasoline Engine made by St. Louis Gasoline Motor Co. A complete vehicle with exception of body. $150 buys the outfit. A. L. DYKE, Hope, Ark.

Having constructed a 3 h. p. light gasoline motor, we desire a well designed gear with or without body, substantially made. Second-hand will be considered.

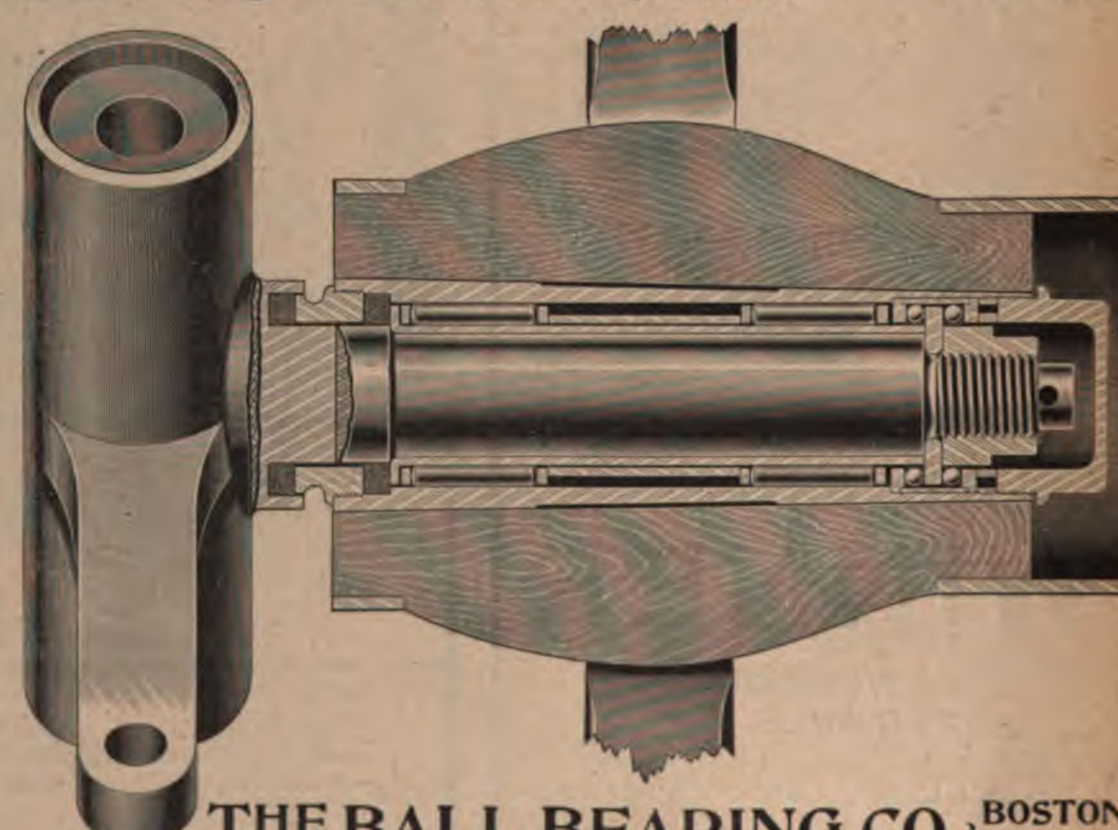
SIBLEY & NEWTON,
227 Bleecker St., N. Y. City.

WANTED.

A gasoline motor weighing 25 lbs. or less, suitable for propelling a bicycle, and as powerful as possible. G. H. NARBONNE, P. O. Box 381, Los Angeles, Cal.



IF you don't see what you want, write us. Our catalog tells the rest. Our factory is the largest and best equipped in the world.



THE BALL BEARING CO.; BOSTON, MASS.

THE PIONEERS

IN THIS LINE OF MANUFACTURING.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS

VOL. V. NEW YORK, OCTOBER 18, 1899. No. 3.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

A Discredited Expert.

Recent scientific literature has been enriched by a contribution from the pen of Hiram Percy Maxim, mechanical engineer and expert of the Electric Vehicle Co., the New York Electric Vehicle Transportation Co., the New England Electric Vehicle Transportation Co., the Illinois Electric Vehicle Transportation Co., the Pennsylvania Electric Vehicle Co., the Columbia & Electric Vehicle Co., the Columbia Automobile Co., the New Jersey Electric Vehicle Transportation Co., etc., combined capital *stock* something over $100,000,000. Representing such large interests, Mr. Maxim might naturally be expected to indulge in large statements. In this we are not disappointed. His statements are as large as the capital *stock*, and they "hold water" no better than the stock does. Cassier's Magazine was the victim, and the title, "The Automobile Situation." To criticise this flabby storage battery puff would be giving it undue importance. We shall simply puncture it and allow it to deflate itself. We quote and cut at random.

This puny champion of that "unmitigated nuisance," the storage battery, begins by asserting that the electric vehicle has driven out all competitors for short distances over good roads. He instances the London electric cabs, discontinued before his ink was dry, and makes the statement that 12 public electric cabs are plying for hire in Paris, when as a matter of fact only one is or was in use, and the number is not likely to be increased. He further says that 100 electric cabs are in service in New York, when it is well known that the company could never keep half that number in condition for service.

Mr Maxim continues: "This classification we are compelled to accept as a result of the survival of the fittest after a protracted struggle. * * * The situation to-day may safely be taken as a healthy one."

It is true that the stock jobbing operations of the storage battery promoters have until recently overshadowed the other motive powers in this country, but Mr. Maxim himself must begin to realize that the struggle is to be further protracted, and that the situation is much healthier now than it was. In Europe the struggle has been much longer protracted than it has here, with the result that there is one solitary public electric cab in the city of Paris, and this is a manufacturer's hobby. Why did he not also mention that almost without exception the American merchants who have been using electric delivery wagons for a period of a year are now looking for steam or gasoline vehicles? Are not these facts embraced in "The Automobile Situation"?

"A gasoline machine," he says, "is practically useless in the hands of any one not having mechanical inclinations." He does not add, as he should have done, that an electric machine

is practically useless in the hands of any one not having electrical inclinations. Again he carefully hides that sick baby, the storage battery. In our issue of Sept. 27 Theodore L. Bunce, an authority on storage batteries, makes the following statement:

"Both [the horse and the storage battery] require when ill the care of an expert—the horse the veterinary surgeon and the battery the skilled electrician."

This is also true of a steam or gasoline machine. It is true of any machine, especially in unskilled hands.

"The storage battery is advancing more rapidly than the gasoline, steam, or other systems."

The editor of The Horseless Age brands this statement as an unqualified falsehood, and challenges Hiram Percy Maxim or anybody else to produce one jot of evidence to prove it. The storage battery has made little progress since the famous discovery of Planté, whose principles Mr. Maxim's corporations are using. In the essential features of weight, efficiency and delicacy it is to all intents and purposes just where it was before these brilliant Philadelphia financiers conceived the idea of a storage battery cab, and no real improvement can be hoped for so long as lead must be employed as a base.

We now come to a statement which excludes Mr. Maxim from the corps of engineers and reduces him ignominiously to the ranks: "The only difference between the electric private carriage and the delivery wagon is in the body and the strength of the parts."

The delivery wagon makes five or ten times the mileage of a pleasure carriage and is compelled to run over rough roads, while the electric pleasure carriage, generally speaking, is confined to the parks, boulevards and well-paved highways. Does Mr. Maxim contend that this wide difference in service, this rougher usage, more continuous service and fuller discharge does not bring the storage battery into the problem? A teller of half truths conveys falsehoods. The electric delivery wagon is for general service not economical; the electric pleasure carriage is an æsthetic success.

Strange to say, Mr. Maxim is once guilty of understatement. He says:

"It is possible to buy to-day in America an electric carriage which will carry either two or four passengers a distance of 30 miles over ordinary grades at an average speed of 11 miles an hour on one charge of its storage battery."

It is possible here and in Europe, too, for that matter, to buy an electric carriage which shall be capable of as much as 40 or 50 miles on one charge over good roads, but how much will it cost and how long will the carriage make this mileage? This, of course, is a storage battery problem, and Mr. Maxim is keeping this a strict secret from the public ken. The battery would fail from the start and quickly disintegrate, as everybody knows, except those whose opportunities are limited to a perusal of such literature as his.

That this blind and infatuated partisan of the lead wagon had doubt in his mind of the truth of his own assertions is shown by the following admission:

"How long this state of affairs will exist depends entirely upon what is accomplished with the other systems."

Wrong, Mr. Maxim; it depends upon how soon somebody tells the truth and refutes you and your errors.

It is to be regretted that a magazine of the standing of Cassier's was innocently led to publish under the guise of "The Automobile Situation" an article that smacks so strongly of the Wall Street curb.

Storage Battery Financiering.

A feature of the past week has been the evident signs of demoralization in the stocks of the electric vehicle and transportation companies, and a change in the executive of the Electric Vehicle Co.

The gentlemen who retired were able financiers, as proved by their annual statement published several weeks ago. The gentlemen who now assume control of the company's affairs are also able financiers, backed by millions of money, but their millions cannot change one atom of the storage battery or make it anything but what it is—a heavy, inefficient, delicate and destructible apparatus wholly unfit for general locomotion, the "unmitigated nuisance" that Prof. Elihu Thomson has properly termed it. Nor will they be able to change the nature of the rubber tire and render it more suitable for sustaining heavy weights and resisting the wear and tear of rough roads. No, in the engineering department their financial ability can be of no avail, for the limit has been reached. Rubber is rubber and lead is lead. Will it be largely occupied, then, in preparing annual statements and figuring out enormous profits on the operation of storage battery cabs, when it is common report that a storage battery lasts only a few months in such service and the rubber tires alone cost the company almost as much as it receives?

The editor of The Horseless Age is not acquainted with the gentlemen who are mentioned as the backers of this unfortunate enterprise, but from what he hears from those who do know them and from what he wishes to believe of them, he is forced to the conclusion that they have been deceived by the storage battery clique of Philadelphia. Fresh from successes in the trolley field, where electricity gives splendid service with a steam engine behind it, they have carelessly assumed that this motive power was destined to prove as practical in road as in track locomotion. In other words, they know nothing of the storage battery, which constitutes the main difference between electric track and electric road locomotion. Let them consult competent and disinterested engineers, and learn the difference between generating electricity direct from a steam engine and boxing it up in a ton of lead and trundling it over cobble stones and car tracks.

Then let them ascertain the actual cost of operating storage battery cabs and their worst fears will be realized. The outlook for the lead cab is utterly hopeless.

For legitimate capital, sound engineering and good commercial ability, the motor vehicle industry offers excellent inducements. It has no gold pockets—except for promoters.

"If."

Some of the communications in our correspondence department seem to the editor to bring out forcibly a peculiarity of the inventive mind, namely, a failure to postulate conditions as they are as a basis for invention and improvement.

If things were different my invention would work, admits the inventor.

If roads were as smooth as a floor, if there were no sharp corners to be turned and no slippery pavements, if speeds were much slower than they are and if there were no machinery to be protected from vibration—then iron-tired three-wheelers might be practical and generally serviceable motor vehicles. But as none of these conditions actually exists three-wheelers cannot be generally serviceable motor vehicles.

If complication and expense counted for nothing in mechanical construction, and if proportion and ease of control were of no importance in a road vehicle, then five wheels might be used instead of four.

If cows were physically and mentally different they might manage two tails conveniently; but being as they are, two separate and independent tails would be developed only at the expense of some more important function, or two would be no more efficiently handled than one. The utility of the cow's tail is limited by the cow's anatomical structure and her power of reflex action, which are as they are and not as the inventor thinks they might be.

If we would make improvements we must improve things as they exist. The new is conditioned upon the old.

"To Cut Prices."

"New company organized to cut prices of automobiles." Such is the heading one frequently sees in the public press nowadays, followed by a long lingo about the automobile trust and the exorbitant prices it is compelling people to pay for vehicles.

There is no trust and none is possible. A few gentlemen started out at the beginning of the year with that lofty idea in mind, but they now find that they are not even in the business, but have simply paid dearly for a little experience.

As regards prices, many silly persons are plunging into this business, knowing as little how to figure the cost of a machine as they do how to build one. These Cheap Johns will fail almost as soon as they begin business, and the undoubted tendency from now on will be toward the maintaining of good prices for good vehicles.

Patents.

In an early issue we shall devote a considerable portion of our space to a treatment of the subject of motor vehicle patents, showing the impossibility of securing basic patents and the almost unlimited range for inventive and commercial enterprise opened by this new industry, and proving that the secret of success in motor vehicle manufacture is not so much patents, as good materials and good mechanics.

Special Steam Boiler Number.

In answer to a communication in this issue and to a general demand for information on this subject, the editor of The Horseless Age announces for an early date a special steam boiler number, in which all classes of boilers available for motor vehicles will be fully treated. Sketches and suggestions from subscribers will be welcomed.

The belated transcontinental tourists, Mr. and Mrs. John, D. Davis are said to have arrived at Chicago with the wreck of a machine. The foolhardy couple announce that they will attempt to reach Denver. We should strongly urge them to pause and reflect on the possibility of being stalled out on the Nebraska or Colorado prairies miles away from a mechanic's aid. Ring the curtain down on this farce!

For good roads and acrobatic riders the motor bicycle will find a field; for exclusive city use, slow speeds and an occasional tumble a motor tricycle is to be commended. For all-around use and the greatest comfort and safety combined, the four-wheeled carriage is without a rival.

Abundance of water and lead are two essentials for good fishing. The storage battery transportation speculators have plenty of both, but are getting few "bites." The storage battery is too heavy a sinker.

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of The Horseless Age, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

Automobile Club of America.

The first regular meeting of this new organization took place on Monday, Oct. 16, at the Waldorf-Astoria, about 35 persons being in attendance.

George F. Chamberlin, in his introductory remarks, rehearsed the objects of the club and advised co-operation with the authorities in the recommendation and enactment of conservative laws affecting the speed of motor vehicles on the highways.

Thomas Clarke, of London, one of the founders of the Automobile Club of Great Britain, was then introduced and told briefly of the work of that well-known body. This club now has over 500 members.

Reports of committees were then received. The constitution and by-laws were accepted, and the temporary committee on membership reported that 85 applications had been received, of which 35 had already been accepted, as follows:

Avery D. Andrews, W. E. Busby, J. A. Blair, Amzi L. Barber, L. L. Barber, Harrison K. Bird, George F. Chamberlin, Dr. E. C. Chamberlain, Juan M. Ceballos, Samuel T. Davis, Jr., Charles P. Doelger, Charles R. Flint, C. J. Field, H. W. Hedge, William H. Hall, Dr. F. C. Hollister, Whitney Lyon, Everitt Macy, A. L. Riker, O. L. Richard, General George Moore Smith, General Roy Stone, J. E. Schermerhorn, George I. Scott, C. C. Vernam, S. H. Valentine, Alexander Winton, John Brisben Walker, D. S. Walker, J. R. Whiting, A. H. Whiting, Clarence W. Wood and Dr. John D. Zabriskie.

The subject of a suitable route for the first club run was touched upon and members were advised to investigate the matter before next meeting, which is to be held in about two weeks.

General Avery D. Andrews has been elected president.

Continental Automobile Company.

A recent incorporation under New Jersey laws is the above named corporation, $8,000,000 capital stock, $3,500,000 of which is 6 per cent. cumulative dividend preferred stock, and 45,000 shares, or $4,500,000, is common stock.

The new company has purchased outright the business of the Winton Motor Carriage Co., Cleveland, O., the Manhattan Oil Motor Co., Jersey City, N. J., and the National Motor Carriage Co., New York. The latter company succeeded the Duryea Motor Wagon Co., and was the owner of a number of patents of Chas. E. and J. Frank Duryea. The Manhattan Oil Motor Co. owned the oil motor patents of Emil Capitaine, Frankfort, Germany, although it was not manufacturing them for carriages, while the Winton Co. was the owner of many patents taken out by Alexander Winton. By this purchase outright the Continental Co. acquires two plants, one in Jersey City and the other in Cleveland.

The directors are Hon. Anthony Higgins, William H. Bulkeley, William H. Lake, W. H. Nixon, Charles T. Welles, George H. Brown, A. M. Jordan and W. C. Hendrickson. Alexander Winton and Viggo V. Torbensen are the engineers, with offices at 52 Broadway, New York.

In its early advertisements the promoters of the company misused the word "fiscal," stating that several trust companies in New York and other cities were acting as their fiscal agents, which would imply that these companies were floating the stock, whereas, they are simply acting as depositaries and as transfer agents for the new stock. The New York depositary is the Continental Trust Co., 30 Broad St.

MINOR MENTION.

H. C. Doman, Oshkosh, Wis., has built a gasoline carriage, which he intends to manufacture.

Geo. W. Taylor, Long Beach, Cal., is constructing a three-wheeled gasoline carriage seating two persons.

The Locomobile Co. of America have appointed E. H. Halsey, of London, agent for the British Isles.

T. C. Hewitt, North Manchester, Ind., is said to be endeavoring to establish a motor vehicle factory there.

Geo. L. Odenbrett, Milwaukee, Wis., writes that the carriage referred to in a recent issue as of his own construction was a Winton.

Dr. M. L. Williams and C. R. Qungerich are trying to get an exclusive franchise to operate public motor vehicles at Champaign, Ill.

The main plant of the Pittsburg Autocar Co., Pittsburg, Pa., will be 200 x 50 ft. There will also be a blacksmith shop and a shipping department.

The Weston-Mott Co., Utica, N. Y., are making up rims in every section up to and including 4-in., regular crescent or flared edges. At the present time they have a capacity of 30 sets a day.

The Hartford Accumulator Co. has been formed at Hartford, Conn., to make and sell electric vehicles. The capital is $1,800 and the incporators are H. B. Philbrick, G. L. R. Eldridge and F. W. Barhoff.

The board of directors of the Electric Vehicle Co. have elected R. McAllister Lloyd president in place of Isaac L. Rice, and the following executive committee: Isaac L. Rice, John Jacob Astor, George H. Day and Martin Maloney.

The International Automobile Co. has been organized under West Virginia laws, with $500,000 capital stock, to "cut the prices of automobiles in half." Gasoline will be employed as motive power. H. A. La Paugh, of New York, is the promoter.

Major R. P. Davidson, of the Northwestern Military Academy, Highland Park, Ill., has received from the Duryea Mfg. Co., Peoria, Ill., the first motor gun carriage ever constructed in this country. The cost of the machine, which fires 480 shots a minute, was $1,200, and the weight is 1,050 lbs.

The advertising department of the Joseph Dixon Crucible Co., Jersey City, N. J., is fertile in booklets descriptive of the various products which the company manufactures. These booklets always contain valuable information tersely put. The latest to hand is devoted to Dixon's Flake Graphite for cylinders and valves, now so extensively and successfully used in all first-class mechanical practice. Inventors and builders of steam and gasoline motors should look into the merits of Flake Graphite.

LONDON NOTES.

London, Oct. 5.

ENGLISH MOTOR VISITORS TO AMERICA.

By the time this letter reaches you Messrs. Clarkson and Capel, of the Clarkson & Capel Steam Car Syndicate, Ltd., of London, S. E., will be in the United States, they having sailed yesterday. Their visit is in connection with their steam vehicles, an account of which appeared in The Horseless Age for July 12 last.

By fire yesterday in Lambeth, at the carriage works of Messrs. Mackenzie, quite a number of Riker electric carriages and no less than 60 electric motors were destroyed. The damage is estimated roughly at $200,000.

PUBLIC STEAM MOTOR SERVICES.

The merits of steam vehicles for use in public transport purposes are steadily coming into favor. During the past week some trials have been carried out at Bath with a "Lifu" wagonette of the Liquid Fuel Engineering Co. The trials were made up the Lansdown Hill, the steepness of which has hitherto been too great to admit of the public being provided with a service of horse omnibuses. Notwithstanding the steepness of the gradients, in parts as much as 1 in 7, the steam vehicle did the ascent with ease and comfort, while even on the descent the brakes with which it is provided kept the 'bus in perfect control. As a result of the trials a steam omnibus service will no doubt be started in the district. Trials of a similar kind and with a similar vehicle have lately been carried out at Leicester, in which town motor vehicle services have already become common and popular.

New public motor services are being announced in various parts of the country. This week a company has been registered with the title The Aberdare Valley Motor Service Co., to organize a service in the Aberdare Valley, in Wales. A service of three vehicles is about to be started between Richmond, S. W., and Hampton Court. The vehicles are all of the Daimler type and have accommodation for 10 passengers. The Edinburgh Autocar Co. has also just commenced a regular service from Newington, Morningside and Merchiston via Gilmore Place, starting at 8 in the morning, and continuing at intervals of 15 minutes.

The increasing use of motor vehicles is beginning to create some alarm among the owners of horse vehicles. Thus at Worthing, a South Coast seaside resort, the local Town Council was last week the recipient of a petition from 56 proprietors of licensed hackney carriages against the relicensing of a motor wagonette which has been running in the town for some time. The result of the petition is not yet known, but it is hardly likely that the horsey people will have their way.

ANOTHER PENNINGTON CHANGE.

Pennington & Baines have just issued the following announcement:

"Finding that our patents and those of the British Motor Co., Ltd., cover the principal successful systems of motor traction, we have come to an arrangement with that company for a working alliance, and in consequence neither our customers nor the customers of the British Motor Co. will run any risk from injunctions for using cars which infringe patents. The business of Pennington & Baines has been acquired by a new company, to whom inquiries should be addressed. Owing to the new arrangements we have now been able to make, the orders for cars placed with Pennington & Baines will be rapidly executed." The new company is styled the Pennington Motor Co., and its address is 40 Holborn Viaduct, E. C., the same as that of the British Motor Co.

DRIVING CHAINS FOR MOTOR CARS.

The number of firms making driving chains for motor vehicles is steadily increasing. In addition to the Eadie Co., recently referred to, Joseph Appleby, Ltd., of the Castle Chain Works, Aston, Birmingham, have just introduced roller chains of 1 in. and 1½ in. pitch for automobiles, the latter being stated to have a breaking load of 3 tons. Coventry chain Co., of Coventry, has also taken up the manufacture of chains suitable for motor vehicles.

Mann's Patent Steam Cart & Wagon Co., Ltd., is the name of the latest concern to enter the lists of builders of steam vehicles in England, a company having this week been formed at Leeds under this title, and with a capital stock of $25,000.

A HINT FOR LAND COMPANIES.

The Motor Mfg. Co., Ltd., of Coventry, have just completed an eight-seated omnibus to the order of the Canford Cliffs Motor Omnibus Co. Ltd., for service near Bournemouth. It is built on the usual Panhard system with 5½-h.p., Daimler motor, and has four forward speeds with reverse motion. The vehicle is to be used in connection with the development of a large estate near Bournemouth, carrying passengers to and from that seaside resort.

LIGHT LOCOMOTIVES ACT CELEBRATION.

Nov. 14 next will see the completion of the third year since the inauguration of the light locomotives on highways act of 1896, which legalized the running of motor vehicles on the common roads of the United Kingdom. To celebrate the event the Automobile Club is organizing for that day an automobile run from London to Sheen, near Richmond, while the same evening a dinner is to be held at the Hotel Metropole, London.

MOTOR POSTAL VANS.

At least one British Government department is displaying considerable interest in motor vehicles—the postoffice, which has already given a trial to vehicles propelled by steam and gasoline and is now devoting attention to those propelled by electricity. For the past few months the postal authorities at Edinburgh have been experimentally running an electric wagon built by the Madelvic Motor Carriage Co., Ltd., of Granton, N. B., the results of which are said to have been so successful that the service is shortly to be extended. The postoffice authorities in London are also about to conduct some trials with an electric wagon. This is being supplied by the Electrical Undertakings, Ltd., of Camden Town, N. W., of which Mr. Leitner is the head. The vehicle will be capable of carrying a load of 1½ tons and is to be able to run a distance of about 32 miles on one charge of the accumulators.

THE MC LACHLAN KEROSENE MOTOR.

The Horseless Age has already published an illustration and brief description of the McLachlan kerosene motor carriage (see issue of July 26 last). The claim for kerosene as compared with gasoline is of course increased safety, cheapness and an absence of such complicated parts as the carbureter, etc. I am unforunately not able to send you particulars of the vaporizer used. It is, however, a small, compact device and is claimed to be reliable in action. The oil is gravity fed to the vaporizer, the admission valve being, as

usual, worked automatically by the suction stroke of the piston. The exhaust valve is controlled by a rocking lever and cam device controlled by spur wheels off the motor shaft, as shown in the illustration. A pressure lamp is employed to heat up the vaporizer at starting, the explosions afterward maintaining the vaporizer at a sufficient temperature, although an electrical ignition device can be fitted if desired. The cylinder is water jacketed, while ample provision is made for lubrication. The motor is made in several sizes, both vertical and horizontal, and both single or double cylinders, ranging from 2½ h.p. up to 7 h.p. The illustration shows a 3 h.p. motor with a 4-in. cylinder and 6-in. stroke. Its weight is given as 196 lbs. and the consumption at 1¼ pints per hour at a normal speed of 500 revolutions per minute.

THE ALLARD MOTOR CAR.

Allard & Co., Ltd., cycle manufacturers, Earlsdon, Coventry, who for some time past have been devoting attention to the construction of motor tricycles, have just brought out a novel little carriage, a two-seated vis-a-vis. The motor is a modified form of the well-known De Dion of 2½ h. p., air-cooled, and provided with electric ignition. It is geared to the rear axle, through the medium of a Didier two-speed gear, by spur wheels. The wheels are of the cycle type, of equal size and fitted with pneumatic tires. A carbureter of the Longuemare type is employed. The body of the vehicle is well suspended, being supported on compass springs at the front and C springs at the rear. The steering is by rack and pinion, while all the control handles, ignition, carbureter, etc., are located within easy reach of the driver, who of course occupies the rear seat. The little carriage weighs only 500 lbs., while its width over all is but 3ft. 6 in. The Allard Co. also have a two-seated sociable—that is, side by side—carriage in course of construction, which will be fitted with a motor of 4 h.p.

PROGRESS IN PARIS.

AUTOMOBILES AND CARRIAGE BUILDERS.

Since the birth of automobilism the carriage buliders of France have enjoyed an unequaled period of prosperity. Before the appearance of the new locomotion French coach builders, with few exceptions, earned little more than a living, and that as repairers rather than builders of carriages. Very few constructed as many as a hundred new coaches a year. In spite of this fact, the good fortune in store for them in the automobile development was not realized by the majority until recently, nor have they made the best use of the opportunity for improvement which the new trade offers. Setting aside the question of adjustment, which does not so much concern them as it does the mechanic, we come to the matter of strength of materials. In the old horse locomotion, now soon doomed, people were content with what they could get in the way of comfort in riding; but in horseless locomotion the public has suddenly become more critical, and other

The Three-Wheeler Again.

Peoria, Ill., Oct. 10.

Editor Horseless Age:

Your editorial on three-wheelers was read with pleasure, and since the public seems to have some interest in the matter a few further remarks may be advisable. There are some things to be said in favor of the three-wheeler, and a long use of both has convinced us that for city purpose the three-wheeler is superior.

Your argument that the fifth wheel would be superfluous seems fallacious, for it is a well known fact that the more points of bearing the steadier the vehicle, and there are a number of reasons why five wheels would be better than four. If the experience of car builders amounts to anything there is no questioning the value of an increased number of wheels. The objections to a large number of wheels for vehicle use are greater than their advantages, however, so that five or six wheels are not to be thought of on most classes of vehicles, and the question finally becomes, What is the number of wheels for a light passenger vehicle which possesses the most advantages and the least disadvantages?

The common answer is four, and the reason given is that the evolution of the horse vehicles has shown four to be best suited for horse use. Admitting this to be true, it proves nothing, for what is best for horse use is not necessarily best for motor vehicle use.

If we had a 10-ft. pole and a 1,200-lb. body to hold it steady we would use the front axle with king bolt for steering purposes, just as the horse does; but this method of steering is not considered good for motor vehicle purposes.

A makeshift method of getting around the problem is to use two steering heads or king bolts—one by each wheel. This reduces the power required to properly handle the steering wheels and is admitted better than the straight axle and king bolt used by the horse. This method of steering has been used on tricylces, which more closely resemble a motor vehicle than does a horse vehicle, and has never been long in favor.

The most popular tricycle or manumotive machine, outside the bicycle, was that having the single steering, like the bicycle, and that same truth holds good in motor vehicles to-day.

The motor vehicle of which the greatest number are being sold and used is a tricycle with bicycle steering. These facts clearly prove that a single wheel controlled as directly as possible by the operator is the best and most popular steering device to-day, and in view of this fact it is but sound judgment to make use of a similar steering on such vehicles as will permit it.

In a vehicle having a carriage body there are certain objections to the handle bar steering, while the front fork support to the forward wheel gives an increased leverage not conducive to durability of the frame. On these accounts different mechanical means of accomplishing the steering are used, but the simplicity, light weight, easy management and wide range of the single wheel are secured. If these advantages were all theoretical, the matter would be different, but if any unprejudiced observer will handle both vehicles long enough to get thoroughly acquainted with same, he will prefer the three-wheeler for most pleasure driving.

CHARLES E. DURYEA.

factors have entered to complicate the problem—the vibration of the motors and the close connection between the body and the frame, rendering the former keenly sensitive to all the joltings of the road. This question of strength of materials takes on new importance, therefore, in the new locomotion, and renders imperative the closest study to determine what material is best suited to each particular case.

The shapes to be given the different materials are also of the first importance, as elegance must be studied as well as strength. Routine or tradition seems to stand in the way of improvement. The automobile industry is now about six years old, yet in all these years of successful exploitation what improvements have been made by the carriage builders, with the exception of the use of aluminum panels in the bodies? Compare this with the progress made in the mechanical construction of automobiles, and then let us ask ourselves whether there is no chance for similar improvement in the shapes and general carriage construction.

If we now come to the price of an automobile body, is it not strange to find that an ordinary body—i. e., a coupé or a victoria—costs as much as a horse carriage, axles, wheels and all? As to maintenance, it is even more expensive. In an automobile of 6 to 8 h.p. the carriage builder's work alone represents at least one-third of the total cost. The reasons for this are deep-laid and difficult to overcome.

The methods employed in carriage building are as old as the world, and for centuries have fallen into a rut. The manufacture of duplicate parts is practically unknown in this industry, and if several pieces of the same shape are made at the same time it is absolutely certain that they will not be identical. In short, the carriage builder has remained an "artiste," looking always for graceful lines and artistic effects. While I am not unmindful of the value of the æsthetic in carriage building, I should like also to see some signs of mechanical development, which is becoming more and more essential every day in the automobile industry. A few of the younger builders are striking out a new path, and it is to be hoped their example will be more generally followed, so that we may soon reach the solution of automobile carriage building, which at present remains to be found.

Comparative Table of John I. Thornycroft.

(Referred to in last issue.)

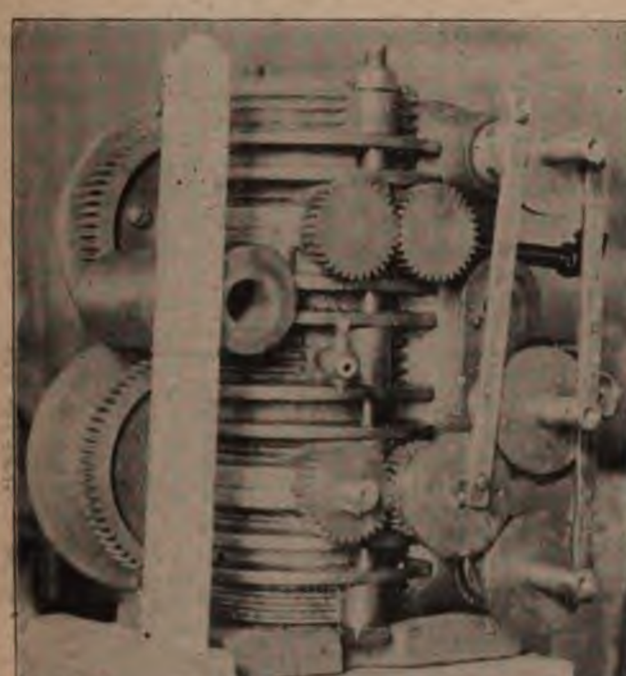
DATA CONNECTED WITH SOME RECENT STEAM VEHICLES.

Vehicle.	Weight and Loads, Tons.					Speed in Miles per hour.	Maximum Gradient climbed.	Engine Cylinders and Stroke.	Fuel.	Gauge with Pressure in Pounds.	Heating Surface.	Grate Area.	Evaporation in lbs. per lb. Fuel.	Per Cent. of Efficiency of Boiler	Pounds of Water per Gross Ton Mile	Pounds of Fuel per Gross Ton Mile.
	Tare.	Fuel and Water.	Nett.	Gross.	Ratio, Nett Tare.											
										sq. in	sq. ft.	sq. ft.				
The "Ravee," by Ransome's Ipswich..	.....	.....	....	19·5	....	6·17	....	8 in. & 8 in. by 10 in.	Coal.	....	177	11·0	5.18	(47)	17.1	3.3
M. Weidknecht's 'bus for 16 persons and luggage	4·7	0·67	1·5	6·87	0·32	9	....	4·92 in. and 4·92 in. by 4·92 in.	Coke.	170	64	3	6.5	58	10 1	1.56
The "Lifu" 2-ton steam lurry	2·39	0·82	2·08	5·29	0·87	8·12	1:10	3 in. and 6 in. by 5 in.	Oil.	250	80	....	8.52	45	8.6	1.01
Leyland 4-ton steam lurry	2·9	0·35	4·1	7 35	1·41	5·7	1:7	3 in. and 5 in. by 6 in.	"	200	110	....	....	....	....	0 6
Scotte omnibus, for 12 persons and luggage	4·13	1·03	1·18	6·34	0·286	6·5	....	4·3 in. and 4·3 in. by 4·5 in.	Coke.	170	120	1·4	5.3	47.3	11.4	2.16
De Dion omnibus, 16 persons and luggage	4·21	0·74	1·10	6·05	0·262	8·5	....	....	"	200	60	1·9	6 2	55 3	6.8	1.1
Serpollet tram with trailer, 100 persons and luggage	11·62 with trailer, staff, fuel, and water.		7·56	19·18	0·65	......	1:20	5·9 in. by 5·9 in. by 6·3 in.	"	75 to 250	43	3	6.0	53.5	...	....
Scotte 'bus with trailer for 26 persons with luggage	5·87 'bus only	1·02	1 0	7·87 'bus only	0·171	7.5	....	....	......	140	120	....	5.3	47.3	11 4	2.16
Martyn's steam 'bus for 22 persons and luggage	2·975	0·5	1·65	5·13	0·554	15	1:15	5 in. and 5 in. by 7 in.	Coke.	125	....	....	...	....	....	....
De Dion boiler, Messrs. Sautter Harlé Cie. trials	....	.....	...	. ..	....	......	....	....	Coal.	200	....	....	6 25	48.3	....	....
Thornycroft steel tip wagon, 6 cubic yards	2·83	0·27	3·00	6·1	1·06	6 to 6½	1:12	4 in. and 7 in. by 5 in.	"	175	65	2·5	6.9	53.3	10.5	1.52
Thornycroft 3-ton wagon at Uxbridge, 1899	2·99	0·56	3·4	6·95	1·13	5½ to 7	1:6	4 in. and 7 in. by 5 in.	"	175	65	2·5	6.9	53.3	9.8	1.42
Thornycroft 6½-ton wagon at Liverpool, 1899, with trailer	3·90	1·25	6·5	11·65	1·67	6½	1:9	4 in. and 7 in. by 5 in.	"	175	83	2 4	7.7	59.7	7.7	1.0

The Hoyt Steam Engine.

A novel little steam engine has recently been built by Gabriel P. B. Hoyt, 202 Lewis St., New York. The first engine built is necessarily somewhat crude and heavy, but it can be seen in operation at any time, running with very little noise and vibration.

Its dimensions are 12 x 11 x 10 in. The chief novelty is the manner in which the pistons are balanced. The piston head is relatively large, hence a short stroke and high speed can be used. Double cranks move in opposite directions so that the pressure is always equidistant from the center of the piston. There are no piston rods, stuffing boxes or cross heads, power being taken direct from the piston.



THE HOYT STEAM ENGINE.

At 60 lbs. pressure and 400 revolutions the engine is said to develop 6 h.p.; at 600 revolutions, 8 h.p.

Oil is placed in the hollow piston, and there is no packing except in the piston.

The details of the engine are given in the drawings.

Fig. 1 is a sectional side elevation of the improvement on the line 1 1 in Fig. 2. Fig. 2 is a sectional plan view of the same on the line 2 2 in Fig. 1, and Fig. 3 is a sectional side elevation of a modified form.

In the piston B, at or near the middle thereof, is arranged a transversely extending elongated slot B′, in which travel wrist pins D D′ of crank arms E E′, respectively secured on shafts F F′, respectively journaled in suitable bearings in the cylinder A, as will be readily understood by reference to Fig. 2, the shafts passing through vertically disposed elongated slots in the walls of the cylinder to allow free reciprocating motion of the piston in the cylinder. The outer ends of the shafts F F′ are connected with each other by suitable gear wheels G G′, and each of the shafts is provided with a fly wheel, H.

When the motive agent alternately admitted to the ends of the cylinder reciprocates the piston B therein then a continuous rotary motion is given to the two shafts F F′ by the action of the slotted piston on the crank arms E E′, engaging with their wrist pins the slot B′ in the piston. As the two shafts F F′ are geared together, it is evident that a uniform rotary motion is given to the two shafts without shock or jar, especially when the piston starts on the return stroke, as the two shafts rotate in opposite directions, due to the gearing connecting the outer ends of the shafts with each other. The piston is said to be always perfectly balanced, as the wrist pins, revolved oppositely by the gear, are at all positions of the stroke at equal distances from the center of the piston on opposite sides of the center line.

As illustrated in Fig. 1, a cylinder of a large diameter and having a piston of a short stroke is employed; but in order to obtain a longer stoke with a piston of less diameter it is necessary to provide the cylinder A′ (see Fig. 3) with an enlargement, A^2, at or near the middle for receiving the enlarged slotted middle portion B^3 of the piston B^2. The operation is the same as above described with reference to Figs. 1 and 2—that is, the slot B^4 in the piston engages the wrist pins D D′ of the crank arms E E′, secured on the shafts F F′.

As shown in Fig. 2, the valves C for admitting and exhausting the motive agent are actuated from one of the shafts by providing the same with a suitable cam, I, actuating a link,

FIG.1.

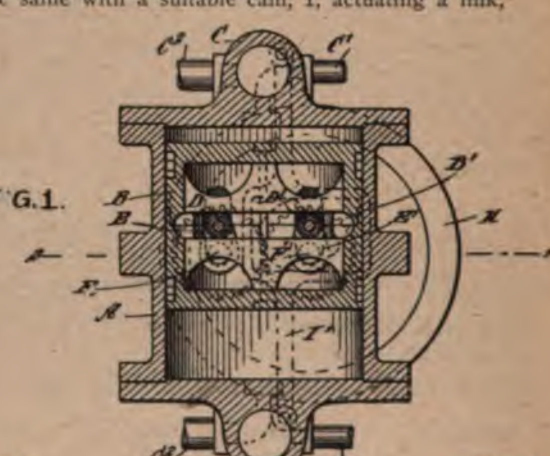


FIG.2.

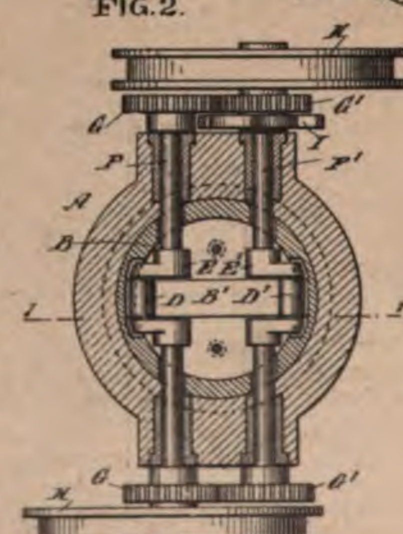
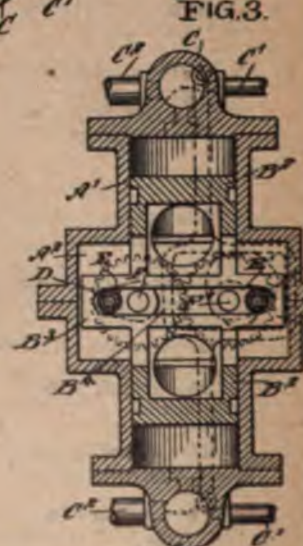


FIG.3.



I' (see Fig. 1), connected with the valve plugs of the valves C. It is evident, however, that other suitable means may be employed for actuating the valves, as the latter, instead of being oscillating valves, may be in the form of the usual slide valves, if desired.

As the shafts F F' rotate in opposite directions, the power can be transmitted from either shaft, according to the direction in which the machinery to be driven is to be run. By the arrangement described a uniform rotary motion is given to the two shafts, jar and shock is avoided, and the engine can be run at a very high rate of speed.

To use steam expansively the two end cylinders could be made of 4-in. bore and the center one of 6-in. bore, and live steam admitted to the outer cylinders and exhausted into the center without change.

COMMUNICATIONS.

Air a Cushion Under All Circumstances.

Clyde, O., Oct. 8.

Editor Horseless Age:

I have watched with interest the articles in your paper on air cushions and am surprised that Mr. Graham and Mr. Bolte should think that air will not make a good spring. What is a spring? A spring is a substance that will regain its original form by its own elasticity when its form has been changed by some force.

All gases (air included) are under tension—that is, they are trying to expand and take up more room, and the volume is only maintained by some force.

If a spring be made of any other substance than a gas it can be overloaded—i. e., stretched beyond its elastic limit—in which case it will not regain its original form. The difference between the original form and the form after its release is called a set. When air is used as a spring it cannot be overloaded, but will always regain its original volume when the force is removed. One peculiar property that gases have is that no matter what the size of a receptacle is that a quantity of gas is placed in, the gas will always fill it. The pneumatic cushion is not an unyielding receptacle, as Mr. Bolte says. It is true that it is so constructed that the volume cannot be increased, but it can be decreased, and will return to its original volume when the force is removed. Decreasing the volume of the cushion increases the pressure of the air and the tension of the spring.

There is a well-known law in pneumatics (Mariotte's law) to the effect that, the temperature remaining the same, the volume of a given quantity of gas varies inversely as the pressure; or, in other words, the original volume multiplied by the original pressure equals the final volume multiplied by the final pressure. The product of the pressure and volume is always the same.

All carriage springs are so designed that the tension increases as the load increases, which is as it should be, the resistance of the spring increasing as the distance the weight moves increases or as the weight itself increases.

If we use a yielding receptacle, as Mr. Bolte suggests, the pressure after compression will be nearly the same as before compression. Thus the tension of the spring does not increase with the weight, unless we take into account the resistance which the receptacle offers to a change of form, and then we are using the receptacle as a spring, in which case there is danger of overloading the spring (material of receptacle), causing it to take a permanent set, or to be ruptured. The volume of the air is then increased and the pressure or tension decreased.

It will take the same amount of work to stop a moving body (if the weight and velocity are the same), whether it be stopped by a solid body or by a cushion; the only difference is that the spring distributes the work through a longer interval of time, which reduces the shock. The longer the time it takes the weight to stop, or, which is the same, the greater the distance the weight travels in coming to a stop, the less will be the shock.

Possibly one trouble lies in trying to use cushions that are too small. It would be better to use cushions of larger volume or more cushions, one above another, and less pressure.

I do not say that pneumatic cushions are better than steel springs, but do say that air is a cushion under all circumstances, as it resists any force that is applied to it, and will regain its original volume when the force is removed.

It is certainly much better than solid rubber.

Yours truly,

GEO. HOLLOWAY, M. E.

Another Foe to Boiler Tubes.

241 Stuyvesant Ave., Brooklyn, N. Y., Oct. 14.

Editor Horseless Age:

In his able and interesting article on the condensation of exhaust steam in your issue of Oct. 11, Mr. Maxim fails to make mention of a most important item which must always be considered in connection with the reuse of condensed steam.

He figures to a nicety the probable back pressure in his condenser, and the percentage of loss occasioned by this back pressure, and argues that the advantage to be derived from using pure water in the boiler, thus preventing formation of boiler scale, will more than compensate for this loss.

Undoubtedly the loss in efficiency due to a slight back pressure would be no greater than the loss due to scaly boiler tubes, and it is certainly true that the use of absolutely pure water in the boiler will prevent incrustation of the tubes.

Mr. Maxim, however, omits all reference to other than the original natural impurities of water and assumes the condensed exhaust steam to be pure; but the boiler, if fed directly with the products of the condenser, would not be receiving pure water.

The condensed article, chemically considered, would be pure water at first, but after a series of trips through the boiler and engine cylinders would become saturated with a substance which engineers, firemen, boiler manufacturers, boiler cleaners and all persons experienced in handling steam will tell you is a worse foe, and forms a more dangerous scale, than the natural impurities of water.

I refer to the lubricating oil used in the cylinders.

Engine cylinders are not generally run without lubrication, and oil is the substance mostly used. This oil is taken up sooner or later by the steam in its travel and carried on through the condenser into the boiler. There it acts in a more harmful manner than the lime, magnesia and other scale-forming ingredients of natural water; it varnishes the tubes in a decidedly effective way, then bakes on, and an extremely thin coating of this oily scale will induce burning of the tubes, and in boilers with thicker tubes than are used in automobile boilers.

To prevent oil from being carried to the boiler all condensing steam plants of any size use appliances known as feed water filters and separators, but even with the most approved apparatus of this kind constant attention is required to prevent the water becoming foul, and it is frequently blown out and renewed.

Numerous patent lubricating substances are on the market for which great claims are made—they will not produce scale in the boiler, etc.; but where some of them do prevent this fault, it is generally found, if proper lubrication is secured, that the cylinders eat these productions by the barrelful and, like Oliver Twist, call for more.

Other dodges, such as non-scaling boiler compounds introduced into the feed water, or the occasional injection of a quantity of ordinary kerosene to "cut" and reduce the density of the oily deposit, have been tried with more or less success; and to obtain perfect freedom from boiler incrustation with consequent liability of tube burning, it is imperative that some method of keeping the feed water free from grease be used.

This, of course, burdens the "chaffeur" with another source of complication and care, and in the writer's opinion it would be wise for builders, or prospective builders, of steam carriages (carriages, not stages and trucks) to seriously consider before applying a condenser to their system whether the game is worth the candle, and if the condenser space and weight could not be more advantageously devoted to an increase in size of water and fuel tanks, then continue exhausting into the atmosphere, and construct the boiler so that a rapid circulation is maintained and with tubes that may be easily removed and cheaply replaced. Yours very truly,

PERRY B. RAWSON.

An Interesting Reply From Mr. Bramwell.

Hyde Park, Mass., Oct. 10.

Editor Horseless Age:

You have slightly misunderstood my former communication. I am not an advocate of any type, whether three wheels or more, only so far as I believe there is a field for three-wheelers as well as for four, and I object to a condemnation of any type in the present state of the art as being unwise.

As to types, I did not intend to convey the impression that I advocated steel shod wheels instead of pneumatics. My intention was to prove that skidding was not inherent in three wheels, and recommended as an experiment the removal of the pneumatics, substituting therefor steel tires, which will not skid, however many wheels the vehicle has, proving, I think, that on a greasy road skidding is caused by the rubber tires, and that it is not a question of number of wheels. The only possible advantage a four-wheeler could have in this respect is that the extra wheel might be outside the slippery spot and help by its friction on the road to prevent to some extent the other wheel from slipping. But how far fetched all this is in an effort to reflect on the three-wheeler.

There are two ways of building three-wheelers—with the single wheel the driver, or, on the other hand, as steerer. Each has its advocates, but no one is competent to settle which is best at present. All questions of this kind have to be arbitrated and settled finally on the road, by continued use in different weathers and conditions. Prior experience with other vehicles is useless almost. Theory will not avail, nor will experiments carried on in the shop or factory.

A three-wheeler having the single wheel as driver is the cheapest form to build, and can therefore be made to come within the means of people of limited means. This I consider is a great field for it.

If the single wheel is made the steerer it will cost more, as it involves a differential motion on the rear axle which is not a desirable feature, irrespective of its added cost.

A four-wheeler, if built right, has its frame swiveled in center of front axle. I fail to see any great difference whether you employ a wheel or a swivel at that point, so far as stability is concerned. In either case your carriage is supported at three points, two being the back wheels, the other the swivel or wheel, as you have three or four wheels.

I conclude therefore that on the ground of stability there is very little difference between a four-wheeler swiveled to front axle and a three-wheeler; certainly far from enough to condemn the three-wheeler; but the difference in cost is probably from $75 to $100, and unless we are going to reduce the cost of motor vehicles I am satisfied their introduction is going to be harder than imagined, despite all the talk and company promotion.

Allow me to criticise your introduction into this discussion of the cow with the single tail. Perhaps you see an analogy here, but I don't. However, you seem to think that because a cow has from remote antiquity possessed but one tail, that fact proves it is the best arrangement, and you do not hesitate to declare that more than one tail would be superfluous. From an inventor's standpoint I think two tails would be an advantange. If two bluebottles simultaneously attack the cow, one on the right and the other on the lift side, it would puzzle a cow with one tail how to proceed—which to attack first, and whichever one it decided on, the other would be getting in its work. If, however, you strike a center line longitudinally through the cow and fix a tail equidistant from this line, one at the right and the other at the left of it, the two tails having in the aggregate only the same work to perform that the single tail has, and not always that, they could be made lighter, thus reducing the load to be carried; also the friction and loss of power, without interfering with the stability of the cow.

The operation of the duplex tail or tails in the case previously cited would cause no hesitation on the part of the cow, but she would instantaneously attack with each tail its respective bluebottle, thus saving mental worry and nervous tension, as well as time and 50 per cent. (estimated) of the power, as neither tail would have to be swung from one side to the other side. It is clear also that on a hot day the cow, instead of fooling away time and energy trying to spray the water of some pond or brook over her back with one tail, could without difficulty, if she had a plurality of tails, distribute a larger quantity of water more evenly in a shorter space of time, thus greatly increasing the tail-end efficiency of the cow without adding any complication worth speaking of. The action, moreover, being more equally balanced (than with one heavy tail when swung from side to side), would plainly reduce vibration, side-slip and skidding, thus obviating all danger of an overturn, resulting, as clearly seen, in not only economizing the energy, but giving the cow much more time for that calm reflective mood so desirable among cows.

On the other hand, however, if the bluebottle was consulted in this matter, it would no doubt decide that a cow minus any tail would be the right direction to work in.

To conclude, as before said in my previous letter, custom proves nothing to the designer of horseless vehicles.

Yours truly,
W. C. BRAMWELL.

Boiler Experts to the Front.

Editor Horseless Age:

The opinion that steam is the power best adapted to motor vehicles seems to be gaining ground all along the line, or at least among those who in the light of practical and actual experience gained in the new industry up to date are carefully considering the pros and cons of the three popular sources of motive power, namely, electricity, gasoline and steam.

Prof. Elihu Thomson, according to The Horseless Age issue Oct. 4, 1899, Vol. 5, No. 1, said that shell boilers are dangerous, and those made of a coil of pipe would not explode. Now, would you not kindly for the benefit of the motor vehicle industry publish sketches and specifications of a type of safety boiler suitable for motor vehicles? If from your own resources you should find it difficult to do so, a request from you in your esteemed journal for designs, sketches and specifications for a safety boiler would no doubt secure them for the acknowledged leading journal in motordom, which undoubtedly The Horseless Age is.

AMICUS.

QUESTIONS AND ANSWERS.

At the request of many of our readers we have decided to open a department of questions and answers. We will endeavor to answer any detail question in practical engineering pertaining to motor vehicles.

Will This Balance?

Baltimore, Md., Oct. 9.

Editor Horseless Age:

I have read with interest Mr. Towle's letter on balanced gas motors, and thoroughly agree with him. I have built at least a dozen different types of gasoline engines for marine and vehicle uses, and in order to further the discussion on this very important subject I send you a drawing of my latest experiment, showing the cylinders, base and gear wheels.

The first one I put in the sand will have two horizontal cylinders, one above the other, 3½ x 3½, with 3-in. cranks working over and under. There will be three shafts, one for each cylinder and one for the fly wheel, each shaft being geared to the others and then to the fly wheel shaft. The gear from the crank shafts to the fly wheel shaft will be 1 to 3. I expect to get 1,000 turns of the fly wheel from 300 turns of the crank shafts, giving the maximum of power from the fly wheel and the minimum of power from the cylinders, with consequently little vibration, as it seems to me. Am I right? I am perfectly willing to be "nailed" if I am wrong.

Yours sincerely,
W. A. SCHAUM.

Primary Battery to Recharge Storage Battery.

Morristown, N. J., Oct. 10.

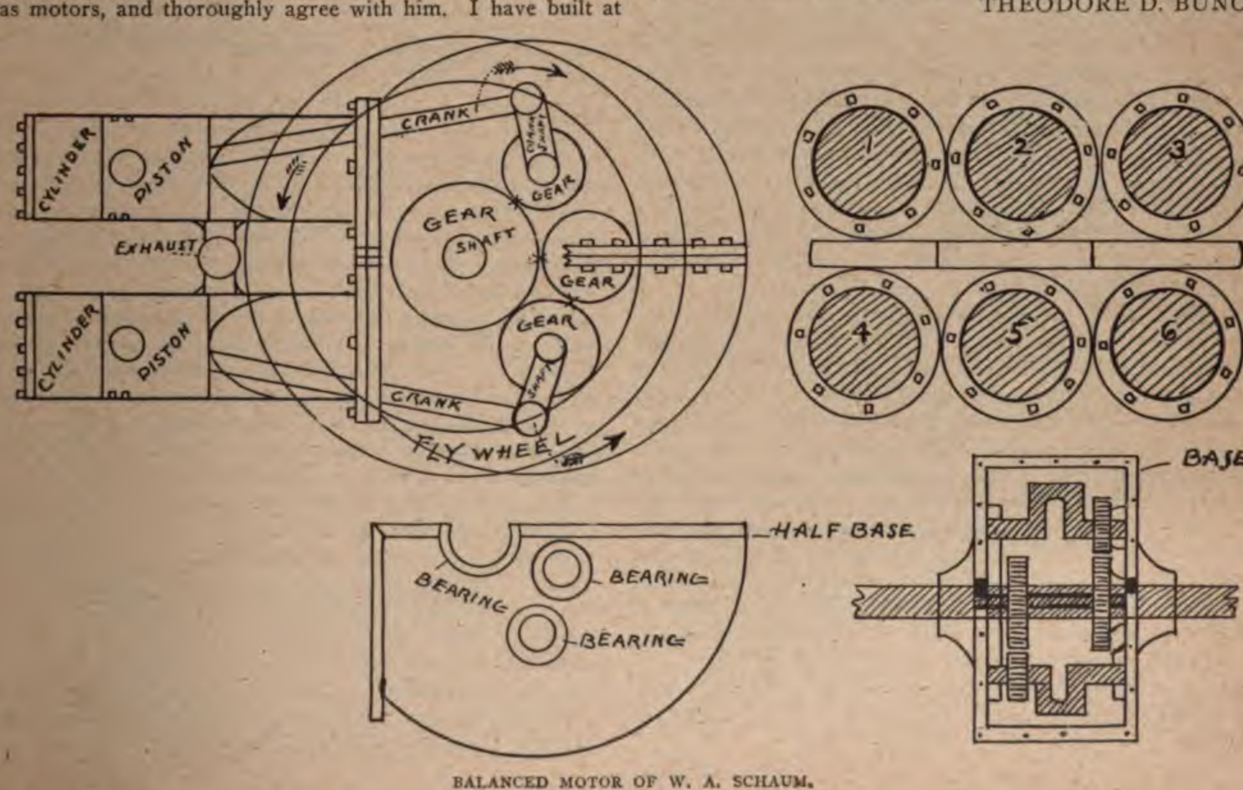
Editor Horseless Age:

Would you advise having a primary battery to recharge my storage battery, and if so, what battery would be best?

E. L.

Answer: Storage cells are the best for igniting the gas in vehicle motors, as they give a uniform discharge during their full capacity. We recommend using two sets of storage cells, keeping one in use and one charging, and changing every time the wagon is used for a day's run. The gravity, crow-foot, or modification of same are the best for charging the storage cells as long as they are kept in constant use. Not less than three primary cells for each storage cell should be used, and four are better. They should be connected in series, and the zinc pole connected to the negative, and the copper pole to the copper pole to the positive of the storage cells.

THEODORE D. BUNCE.



BALANCED MOTOR OF W. A. SCHAUM.

Loose Nuts.

By R. I. Clegg.

A motor vehicle, as indeed every other machine exposed to exceptional shocks and strains, may be compared to a chain in which the maximum strength is determined by the condition of the weakest link. Among the more important of these links must be included the bolts and nuts employed to connect two or more portions or pieces of material: This method, i. e., bolts and nuts, of which there are numerous forms, is the one generally employed; however, the rivet is also useful and the method adopted must depend upon the circumstances of the case, as the nature of the materials to be connected, etc. Both methods named are employed to make permanent connections; that by bolts and nuts is also used to form temporary connections.

However, it is possible to do so, as in the union of built up frames, supporting brackets, etc., the advantages of making permanent connections by riveting are worthy of consideration. It is true that the bolt and nut permits of easy adjustment, but this advantage is oftener abused than properly utilized, as may be shown in the tendency of high speed steam engine practice.

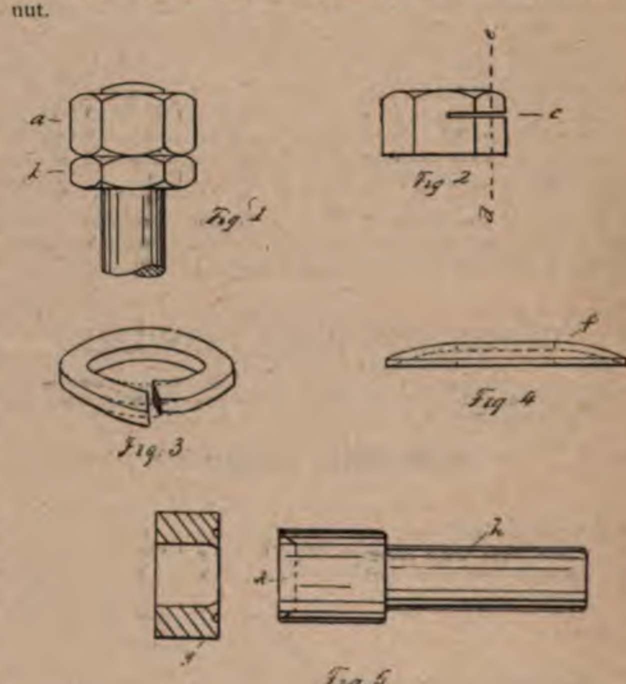
Considering the nut and bolt as essential portions of an automobile, how shall we maintain the relative position of the one to the other? The sudden strains and the constant vibrations tend to loosen the nuts and thereby destroy the efficiency of the arrangement. To obviate this, several arrangements have been made for locking the nuts; one of the commonest forms is shown in Fig. 1. One of the nuts is termed the lock or check nut; usually it is half the thickness of the ordinary nut. The nuts are wedged tightly against each other on the screw, and thus, it will be noted, the load transmitted by the bolt is born by the outer nut. The thick nut should, therefore, be on the outside as shown in Fig. 1. In actual practice the thin nut is often on the outside for the reason that ordinary wrenches are generally too thick to act on the thin nut when placed under the other. Sometimes a compromise is effected by having each nut of a thickness equal to three-fourths of the thickness of an ordinary nut. The height of an ordinary nut is usually equal to the diameter of the bolt. The thin check nut in Fig. 1 is one-half that dimension. Some engineers have advised a different ratio, as, for example, one of the nuts having a thickness equal to three-quarters of the diameter of the bolt, and the other nut being equal to seven-eighths.

Another variety of this arrangement was patented some years ago by Brown & Bailey. The threaded end of the bolt has a right-hand thread, upon which fits the nut, as say b in Fig. 1; instead of this thread going to the end, the diameter of the bolt is reduced for a certain distance from the end and a left-hand thread cut upon it. The locking of the two nuts is efficient, but, of course, there is the extra work involved in the manufacture of the bolt, and as the screws are of different diameters, and one right and the other left-handed, the bolts must be made specially for the purpose for which they are required, as only a very small variation in the thickness of the connected piece is admissible. The reduction in diameter of the bolt, to permit the lower nut to pass over it, was another defect which prevented the more general use of the device.

In Fig. 2 I show Wiles's lock nut, which is now often used on quick-running machinery, subjected to a good deal of vibration.

The nut is half cut through by a saw as at c, and the slit is slightly closed by a blow from a hammer before the nut is screwed down in place. This is all right for nuts up to 1 in. in diameter; over that size the inventor uses a small set screw which fits in a tapped hole drilled along the line d e. After the nut is screwed home the set screw is used to slightly close the jaws and the nut then grips the screw thread tightly.

This idea of bringing a tension on the nut to grip the screw threads has been utilized in various ways. In the helicoidal nut a closely wound spring is pressed into the form of either a square or hexagon nut, and tapped to size. When in place under strain the coils slightly separate and cling the more closely to the bolt. Another form of spring nut is cut through in a stepped method and has a similar action to the helicoidal nut.



When the size of the nut will permit, a hole may be drilled through and a set screw abut against the threaded surface. To avoid marring the surface, the point of the screw rests against a bit of soft metal introduced into the hole before the insertion of the screw. There are many variations of this scheme; the end of the bolt may be turned down where the screw point comes in contact; the metal, against which the nut is to fit, may be counterbored and the nut turned down to enter the cavity and a set screw passing through the side of the chamber fit against the nut; the nut may be turned down to fit in a thick washer, the latter doweled to prevent rotation and having a set screw passing through and abutting against the nut as before, and so on.

At Fig. 3 is shown Grover's spring steel washer. When the nut is tightened up the washer becomes nearly, but not quite, flat, and its elasticity neutralizes the play of the nut on the bolt. At Fig. 4 is an arrangement I have used with considerable satisfaction, in a few instances, and do not doubt its simplicity merits a wider field of usefulness. It is a steel washer dished out to the form shown at f; under pressure it flattens out, giving a good surface for the nut to rest upon, as shown by the lower lines in Fig. 4, and as a spring resistance prevents the slacking back of the nut.

Some years ago I came across a nut which was pressed into shape, having a small projection adjuring the hole; after the nut was tapped the projection was flattened down, squeezing one or two threads out of truth. The nut would thus bear tightly on the thread, and if the projection was carefully proportioned and the flattening performed with an intelligent understanding of the needs of the case, the method would be of service. Owing, I dare say, to the difficulty of obtaining the conditions here mentioned, the device is seldom used, so far as my experience goes.

In Fig. 5 I submit a variation of the idea. Here g is a nut in section, h is the shank of a punch recessed at k. Let us suppose that the nut g is tapped to size and dropped into a fixture on press and the punch h brought down the requisite amount to set in the end threads of the nut g, as shown by the indentation. Whatever the merits of this method—and, of course, I cannot be an impartial critic—it is evident that the device requires no additional piece to be added to the nut, and the latter will have no projecting parts or screws to limit its usefulness. So far as the writer is concerned it is entirely at the service of his readers. In addition to the check nuts, elastic washers and set screws, etc., stop plates are used to some extent. The stop plate has a gap cut in one side to fit the nut, or sometimes has a hexagon or square hole cut through to fit over the nut; after the nut is screwed down the plate is fastened by set screws to prevent the nut rotating. Another plan is to drill a hole through the bolt above the nut and drive a split pin or cotter through. This has been varied by a washer, having extensions on the rim, and a square hole to fit a square on end of bolt under the split pin. On the nut being in place, the extensions on the washer are bent down to rest against the flats of the nut and the square bolt prevents the slacking under vibration, etc. Another form has the washer pinned to the machine under the nut, and the extensions, or retaining flanges, are bent up to hold the nut, as in the previous instance.

Each method enumerated has its special advantage, and in selecting one of them, of course that most suitable for the case under consideration should be chosen.

There is a tendency toward the use of bolts and screws of bicycle dimensions in motor vehicle work, and if we can be sure of the same general care and judgment in the proportion to strain, as experience has found appropriate, little fault may be found. Unfortunately the designer pares down the dimensions at the cost of strength, that is really needful as a fair factor of safety, and on the other hand the user expects to use the same tools the carriage smith employs in his trade.

Between the devil and the deep sea the industry is liable to fall into disrepute, for what avails the most scientific system of check nuts as opposed to an overstrained bolt?

It is evident that the unavoidable weight of frame and motor, to survive ordinary road work and sustain and preserve relative alignment and adjustment, calls for fastenings upon which absolute reliance can be placed, and this implies generous dimensions of bolts and screws as well as a good system of checking nuts.

Gas Engine Diagrams.

By E. J. Stoddard.

The slope of the expansion line of the indicator diagram indicates the net result of the different processes going on at every point of the working stroke of a gas engine.

On the one hand the combustion continues to supply heat throughout the stroke; on the other hand the gases are giving up heat to the cylinder walls; moreover there is apt to be more or less leakage.

When the charge is ignited its pressure increases, but its specific gravity remains the same, so that a small leak will produce a disproportionate effect.

The following method of estimating and illustrating the action of the gases at different points of the stroke seems to me simple and convenient.

Draw the vacuum line, and call it the "axis of X." Draw the usual vertical line at the point corresponding to the head end of the cylinder and call it the "axis of Y."

If the effects of the different processes going on in the cylinder balance each other the expansion is adiabatic and the tangent to the expansion line at any point always cuts the "axis of X" at a point 1.73 times the distance of the point of tangency from the axis of Y, and it cuts the axis of Y at a point 2.37 times the height of the tangent point from the axis of X.

If we draw a tangent to a given point in the actual diagram and then construct a straight line through the said point, by the above rule, the divergence between these two lines will represent the rate at which the charge is gaining or losing heat, according as the adiabatic tangent is below or above the tangent to the curve. Of course this is on the supposition that the cylinder is tight. If there is a considerable leak the fact will be illustrated by the unusual steepness of the actual tangent.

It is customary to represent the expansion line by an equation of the form,

$$(1)\quad yx^{K} = C$$

in which the value of K represents the slope of the line; it is steeper for larger values of K.

K is given a value that will produce a curve averaging the same as the actual curve.

As a matter of fact, K would have to vary in order to produce the actual line.

Equation No. 1 may be put into the form,

$$(2)\quad y = C X^{-K}$$

Differentiating 2 and dividing by the differential of X, we have

$$(3)\quad \frac{dy}{dx} = -K C X^{-(K+1)}$$

Substituting the value of C from 1 and reducing we have

$$(4)\quad \frac{dy}{dx} = -\frac{Ky}{X}$$

This is a general expression for the slope of the tangent to this kind of a curve.

Substituting in the general equation for the tangent at any point we have

$$(5)\quad y - y_1 = -\frac{Ky_1}{X_1}(X - X_1)$$

If in 5 we make $y = 0$, we get

$$(6)\quad X = \left(1 + \frac{1}{K}\right) X_1$$

for the position of the point at which the tangent cuts the axis of X.

If we make $X = 0$, we get

$$(7)\ y = (1 + K)\ y_1$$

for the position at which the tangent cuts the axis of Y. By the use of equations 6 and 7 we can get the value of K for any point in a given expansion line.

For instance, in the figure, at a point, A, we draw a tangent, a b, cutting the axis of X at a point, b, 3.2 in. from the axis of Y, and cutting the axis of Y at a point, a, 8.03 in. from the axis of X.

The co-ordinates of A are $X_1 = 1.925$ and $Y_1 = 3.2$.

Substituting in 6, we get

$$3.2 = (1 + \frac{1}{K})\ 1.925$$

or

$$K = 1.51.$$

Substituting in 7,

$$(1 + K)\ 3.2 = 8.03,$$

or

$$K = 1.51.$$

Therefore the equation of the curve at this particular point is

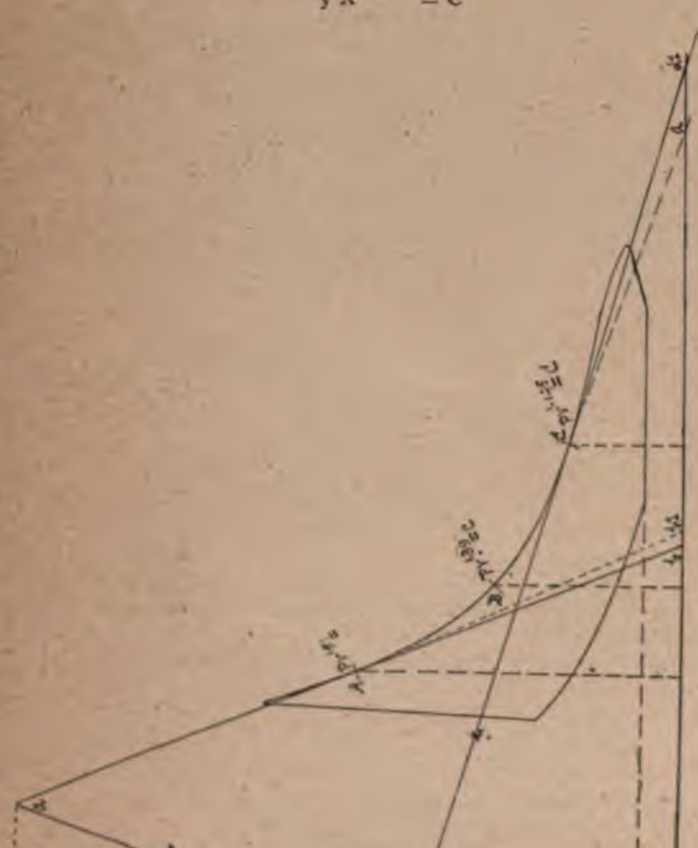
$$y X^{1.51} = C$$

At the point B, in the same way, we find that the equation is

$$y X^{1.39} = C$$

and at the point C,

$$y X^{1.145} = C$$



NOTE.—The check upon the work above referred to relates to the measurements taken and not to the accuracy with which the tangent is drawn.

Drawing the tangent a b, at the point A, and the corresponding tangent A b 1 to the adiabatic line, we see that the charge is losing heat to the cylinder walls at a rate indicated by the angle b A b 1.

So at the point C we find in the same way that the charge is absorbing heat at a rate indicated by the angle d C d 1.

The approximate equation of the curve is

$$y X^{1.305} = C$$

The difficulty with this method is to draw the tangent accurately at the given point. In this instance a ruler and a watch maker's magnifying glass were used, and the values given for K by the two equations never varied as much as .005. Of course the two values may be added together and divided by 2 or multiplied together and the square root of the product taken, to get a closer approximation. However, the two values of K will serve as a check upon the accuracy of the work. If they are not substantially equal it indicates that the work needs revising.

The diagram is a copy of a reproduction of a diagram from the Atkinson engine. This engine was a successful attempt to increase the efficiency of the gas engine by decreasing the slope of the expansion line. This object was attained by increasing the speed of the piston on the working stroke.

The ignition occurred at the dead center and the speed of the piston increased gradually so that the beneficial effect occurred well along in the stroke where the pressure was much reduced, as shown above, so that the increase of efficiency from this cause was small.

Automobile Tire Pumps.

Something which every owner of an automobile needs is a tire pump. Probably the best stationary hand lever pump in the world is made by the Gleason-Peters Air Pump Co., 40 W. Houston St., New York. It is made from malleable iron, can be operated by hand, is attached to a fixed support and possesses all the advantages of that class of pump known to the trade as lever pumps. Another important advantage is that whether portably held in the hand or affixed to a support,

the best possible results are attained, as the leverage on the piston rod increases as the resistance on the piston increases, thereby securing the powerful leverage of the well-known "toggle-joint" principle as the piston finishes its stroke.

This pump is particularly adapted to automobiles, and is said to be the only hand pump in the world that will give a pressure of 400 lbs. to the square inch.

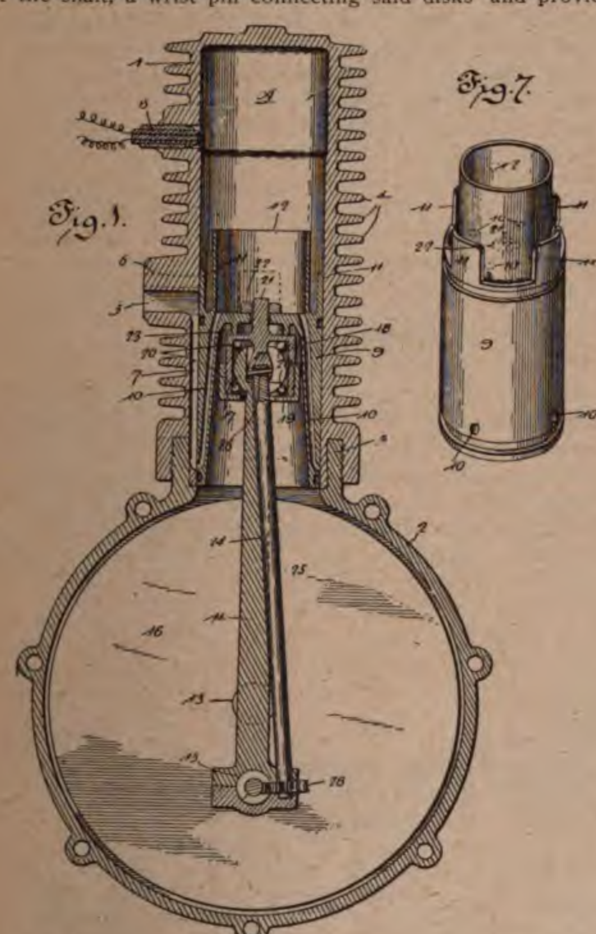
This company also makes power pumps for manufacturers of automobiles.

MOTOR VEHICLE PATENTS of the world

UNITED STATES PATENTS.

No. 634,654—Gas Engine.—George A. Whitcomb, Framingham, Mass., assignor of one-third to Evans W. Hodgdon, same place.

Claim.—In a gas engine, the combination with a cylinder having feed and exhaust ports, of a reciprocatory piston provided with cut-off devices for controlling said ports, a driven shaft, crank disks carried by terminally separated members of the shaft, a wrist pin connecting said disks and provided



with a worm, a channeled pitman mounted at its inner end upon said wrist pin and having a swivel connection at its outer end with said piston, a spindle arranged in the channel of the pitman, and pivotally connected at its outer end to an axial hanger on the piston, at its point of intersection with the pitman, said spindle lying at an angle to the pitman, and a worm gear upon the spindle engaging said worm and forming a direct connection between the spindle and wrist pin, substantially as specified.

No. 634,827—Driving Mechanism for Motor Vehicles.—Gustav Mees, Wetzikon, Switzerland. Application filed Jan. 5, 1899.

Fig. 1 is a horizontal longitudinal section of the improved driving mechanism. Fig. 4 is an end view showing the reversing levers. Fig. 6 is a detailed view of the toothed segments of the reversing levers.

This invention has for its object a gearing by means of which the power of a motor working with a constant number of revolutions in always the same direction of rotation is transmitted by an intermediate shaft in such a way that the latter may be operated in both directions of rotation and also driven at different speeds.

There are three separate sets of gearings arranged on a common intermediate shaft, W, Fig. 1, which are operated from the motor shaft M by means of bevel gear K K' K^2, and the driving of two of the gearings takes place by means of the wheel K' traveling to the right (forward travel) and that of the third gearing from the wheel K^2 rotating to the left (backward travel). In order to obtain an engagement of the separate gearings free from shock, they are arranged on the planet wheel system—that is to say, a suitable number of so-called "planet wheels," P' P^2 P^3, are in constant engagement on the one hand with a central internal wheel, J' J^2 J^3, and on the other hand with an outer ring or wheel, Z' Z^2 Z^3, having internal teeth. When one gearing is running without driving the vehicle, the planet wheels P' (P^2 P^3) are carried planet fashion around the inner wheel J' (J^2 J^3) by the ring of internal teeth Z' (Z^2 Z^3) and carry with them a brake wheel S' (S^2 S^3), on which they are mounted by means of bolts, b' (b^2 b^3). If, however, the circling of the planet wheels be stopped by rendering the brake wheel S' (S^2 S^3) and the bolts b' (b^2 b^3) stationary by putting on the brake B' (B^2 B^3), Figs. 1, 2 and 3, the power will be transferred through the then stationary but revoluble planet wheels from the toothed ring Z' (Z^2 Z^3) to the internal wheel J' (J^2 J^3) or vice versa, according as one or other of the two wheels Z' or J' is the driving wheel. If the toothed ring Z' (Z^2 Z^3) is the driving wheel, the transmission will take place from the larger diameter of the wheel to the smaller diameter of the internal wheel J' (J^2 J^3)—that is to say, an increase of speed will be attained for rapid traveling, while, vice versa, the movement will be retarded or rendered slower if the smaller internal wheel be the driving one—that is to say, the transfer will then take place from the interior to the outside, for instance, for climbing hills.

The combination of the three gearings is such that the gearings Z' P' J' and Z^2 P^2 J^2 are operated by the bevel wheel K', running to the right, and the gearing Z^3 P^3 J^3 is operated by the bevel wheel K^2, running to the left. If, accordingly, one of the two first-named gearings be thrown into action, the carriage will travel forward slowly or rapidly, according to the gearing engaged. On the other hand, the carriage will travel backward when the gearings Z^3 J^3 P^3 are thrown into gear. If the brake B' be applied ror rapid traveling or high gear, the power is conveyed from the bevel wheel K' by means of the toothed ring Z', planet wheels P', and internal wheel J' directly to the intermediate shaft W. If, on the other hand, the gearing be thrown into action for hill climbing (low gear), the transmission of power will take place from the wheel K', through the arms and the hub of a wheel, T, on which K' is mounted, to the internal wheel J^2, keyed on the said wheel, and thus to the planet wheels P^2, which then drive the toothed ring Z^2, which is mounted on a wheel, C, keyed on the inter-

mediate shaft, which thus receives the power. Similarly on the gear being thrown into action for the rearward movement, the power passes from the bevel wheel K^3 through a wheel, F, on which same is mounted, to the internal wheel J^3, keyed on the hub of said wheel F, and thence to the planet wheels P^3 and toothed ring Z^3, mounted on a wheel, E, keyed on the shaft, which thus receives the power.

The brakes necessary for throwing the gear into action are operated by two levers, V R, arranged at the side of the carriage frame, which are keyed on two shafts, v and r, mounted concentrically one within the other in eyes or bearings, a. The front lever V, mounted on the lever shaft v, controls the brakes B' and B^2 for the two forward gearings by means of levers, v' v^2, keyed firmly on said shaft, while the reversing lever R, lying behind it, controls the two brakes, B^3 and B^4, arranged on a single brake wheel, S^3, by means of the hollow shaft r and levers r' r^2. If both levers stand in a middle position none of the four brakes are applied and all three gearings consequently run without driving the vehicle. If the lever V for the forward gearings be moved to the right, the brake B' is put on and the gearing for rapid travel is set in action. If, on the other hand, the lever V be put over in the reverse direction (to the left), the gear for slow traveling is thrown into action by the operation of the brake B^2. The reversing or backward travel gearing, however, is engaged by the reversing lever R being moved to the right or to the left, in the first case by means of the lever r' and brake B^3 and in the second case by means of the lever r^2 and brake B^4. It is self-evident that only one gearing can be in action, so that thus when one of the two levers is placed to the right or left the other must stand in the middle position.

The gearing for backward travel may also be used as an instantaneous brake—that is to say, for immediately stopping the vehicle, as by the application of the reversing lever R, after of course previously throwing the forward gear out of gear, the active force or momentum of the carriage must first be overcome before the backward travel gear can come into action. The putting on of the brakes for the backward travel gear therefore acts precisely as if a steam vehicle were brought to a standstill by reversing the steam.

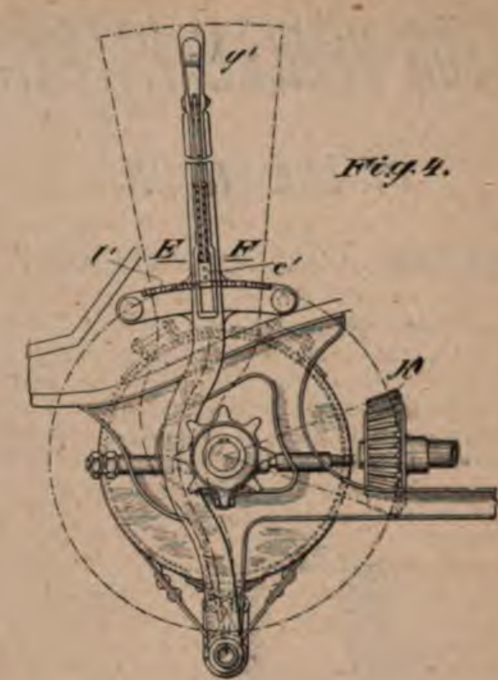
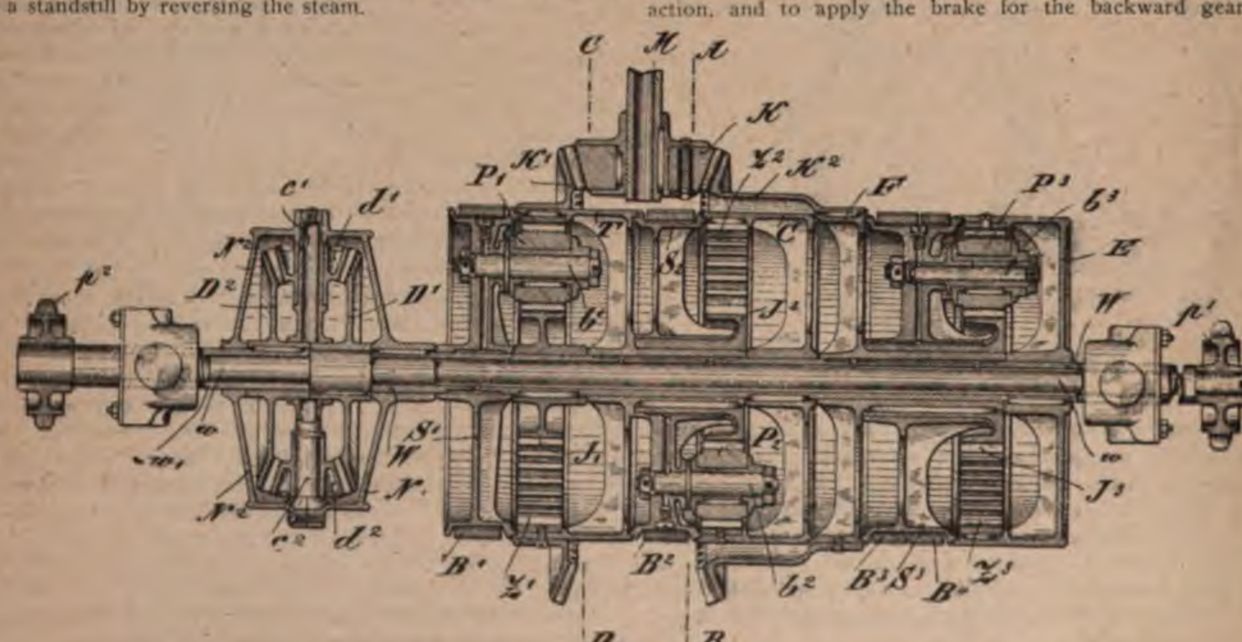


Fig. 4.

Fig. 6.


In order in case of danger that no time may be lost by the successive manipulation of two levers, both levers, V and R, are connected with one another in such a way that only the latter needs to be manipulated in order simultaneously to throw out of action the forward gear, which may be in action, and to apply the brake for the backward gearing.



For this purpose the toothed segment l for locking the reversing lever R is fixed to the carriage body and a bolt or pawl adapted to be operated by a handle, g, is provided on the reversing lever to engage in the teeth of said segment, while the toothed segment l' for the forward lever V is screwed on a cross arm of the reversing lever R, Fig. 6. The lever V may accordingly be placed to right or left independently of the lever R, while, however, on the reversing lever R being moved the forward lever V must be carried along with it. If, when the carirage is traveling rapidly forward and the lever V is in the position to the right, the vehicle is required to be suddenly stopped, it is only necessary to move to the left the reversing lever R, which was in the middle position, in order simultaneously to bring back the forward lever V into its middle position, and thus to immediately throw out of action one after the other the forward gearing and put on the brake B^4 for the backward gearing. On the other hand, the vehicle may be rendered stationary by placing the reversing lever to the right when the forward lever in the case of slow traveling has been placed to the left. In that case also the forward gearing for the slow traveling is first placed out of action and immediately afterward the brake B^3 for the backward gearing is put on. The power of the motor is transferred from the shaft W, which is driven by one of the three planet wheel gearings, by a differential gearing, to the shafts w and w', on the ends of which chain wheels, p' and p^2, are keyed to allow of the carriage wheels being directly driven therefrom. The shaft w is mounted in the hollow shaft W of the planet wheel gearing and for the purpose of a better guidance projects a little into the shaft w', which is also a hollow one and which forms a continuation of the shaft W. The differential gear consists of the differential wheels D' D^2 d' d^2, which are in engagement with one another and are carried along by a capsule-shaped disk, N', keyed on the shaft W by means of bolts c' c^2. The disk N^2 serves for incasing the whole gear.

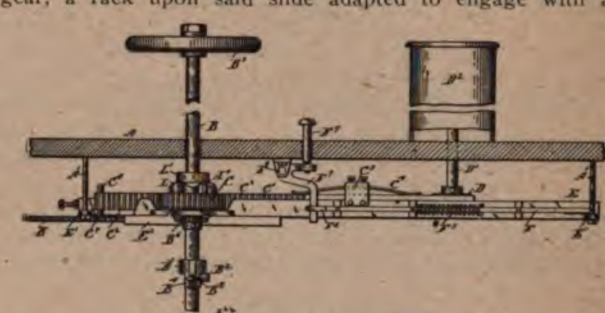
The mode of working of the differential gear is as follows: If the resistance of both carriage wheels is equal, which is the case when traveling in a straight line, the two wheels D' and D^2, and therewith also the corresponding shafts w and W', are simultaneously operated by the intermediate wheels d' d^2, which are stationary on the connecting bolts c' c^2. If, however, the vehicle be moved in sharp curves or turns, the resistance of the inner wheel, which is describing a smaller arc, is greater than that of the outer wheel, which travels over a longer course. The disturbance of the equilibrium of the forces thereby produced in the differential wheels D' D^2 d' d^2 is again automatically re-established by the differential wheel D' in consequence of the rotation of the intermediate wheels d' d^2 on the connecting bolts lagging to an extent equal to what the wheel D^2 travels in advance, or vice versa, according as the greatest resistance arises on the wheels D' or D^2. Thus the carriage wheel traveling in a smaller arc is operated more slowly than the outer wheel which is traveling in a larger arc in accordance with the difference of length of the two curves. If both wheels were driven at an equal speed, the inner wheel, in order to equalize this difference, would slip on the ground, so that the steering would be rendered difficult, if not impossible.

In case it be not desired to utilize the backward travel and to limit the movement to both speeds for forward traveling, the bevel wheel K^2, wheel F and backward travel gearing (consisting of Z^3, J^3, P^3 and E) may be omitted. In this case, in order to render it possible to stop the vehicle immediately in spite of the omission of the backward traveling gear by gripping the reversing (or in this case only brake) lever, the brake wheel S^3 is firmly connected with the shaft W or with the capsule of the differential gear, on which wheel S^3 the two brakes B^3 and B^4, acting in opposite directions, are mounted.

The difference between the gearing containing the mechanisms for backward travel and the gearing without the same consists in that in the former case the back travel gear is set in action, in case the brake disk S^3 is held fast long enough, by means of one of the brakes, while in the latter case the carriage is only stopped when the brake wheels are held fast still longer.

No. 634,832—Brake and Power Apparatus for Electrically Driven Vehicles.—William E. Pearson, Boston, Mass. Application filed March 4, 1899.

Claim.—In an apparatus of this class, a brake shaft having a pinion gear, a slide adapted to be operated by said pinion gear, a rack upon said slide adapted to engage with and



operate the electric controller mechanism; a pin, as C^3, on said slide engaging with a narrow opening in a sliding plate, as K, the said sliding plate having a rack adapted to engage with a pinioin on the brake shaft and to be operated by it, whereby the motion of the sliding plate is at intervals communicated to the said slide, substantially as and for the purpose set forth.

AUSTRALIAN PATENTS.

From Phillips, Ormonde & Co., patent and trade mark agents, 533 Collins St., Melbourne, Victoria, the following particulars have been received of motor vehicle patent applications in Australasia, of whom further details may be obtained.

Apparatus for Propelling Vehicles and in Parts Thereof, and in Vehicles Adapted for Use with Propelling Apparatus. —A. L. Barber, of No. 11 Broadway, New York, in the County and State of New York, U. S. A. (assignee of F. O. Stanley and F. A. Stanley, both of Newton, U. S. A.). Aug. 9, 1899. No. 16,432. In the Colony of Victoria.

Controllers for Electric Motors.—E. Phillips, of 533 Collins St., Melbourne, Victoria (communicated by H. P. Davis, of Pittsburg, U. S. A., and G. Wright, of Wilkinsburg, U. S. A.). Aug. 31, 1899. No. 16,469. In the Colony of Victoria.

Gas or Internal Combustion Motive Engines.—W. L. Corson, of San Francisco, U. S. A. May 25, 1899. No. 11,627. In the Colony of New Zealand.

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

FOR SALE.

A Haynes-Apperson two-seated surrey, with canopy top. Run about 100 miles and in good condition.

A. B. GARDNER,
Dowagiac, Mich.

FOR SALE.

A "Locomobile," direct from the factory, with makers' latest improvements, and tools, bell, etc., besides. Price, $800.00. Can be seen in New York.

Address K. B.,
Care HORSELESS AGE.

WANTED.—*Vol. 1, No. 1, Vol. 2, Nos. 5, 6, 7, 8, 9, 10, and Vol. 3, No. 1.* A new number of the weekly will be given in exchange for any one of these, *if in good condition*, and for Vol. 1, No. 1, four numbers will be given if in good condition. HORSELESS AGE, American Tract Society Building, Nassau and Spruce Streets, New York.

WANTED.

Automobiles. New or second-hand. State condition and price. Address

AUTOMOBILE,
Columbus, Ohio.

FOR SALE.

Second-hand automobile in first-class shape. Price right.

GILBERT J. LOOMIS,
Westfield, Mass.

FOR SALE.

$150.00 cash, 4 h. p. horizontal double cylinder gasoline motor.

STANDARD AUTOMOBILE CO.,
1218 Betz Building, Philadelphia, Pa.

The Woodruff Patent System of Keying...

Is used by The Largest Automobile Works in this Country
For Keying Gears, Sprockets, Cranks, etc., to Shafts.

WE CARRY 41 SIZES OF KEYS AND CUTTERS IN STOCK AND MAKE SPECIAL SIZES TO ORDER.

SEND FOR CIRCULAR.

THE

WHITNEY MFG. CO.

HARTFORD, CONN., U. S. A.

WANTED.

Special contributors to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of THE HORSELESS AGE, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

SPECIAL OFFER.

BACK NUMBERS.

We have no more complete files and have decided to offer miscellaneous back numbers of THE HORSELESS AGE, from December, 1895, to March, 1899, at the following prices:

12 Assorted, - - - $1.00
6 " - - - - 50 cents.
Foreign, 5 and 2½ shillings, respectively.

THE HORSELESS AGE,

American Tract Society Building,
Nassau and Spruce Streets,
NEW YORK.

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of THE HORSELESS AGE, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

SPECIAL OFFER.

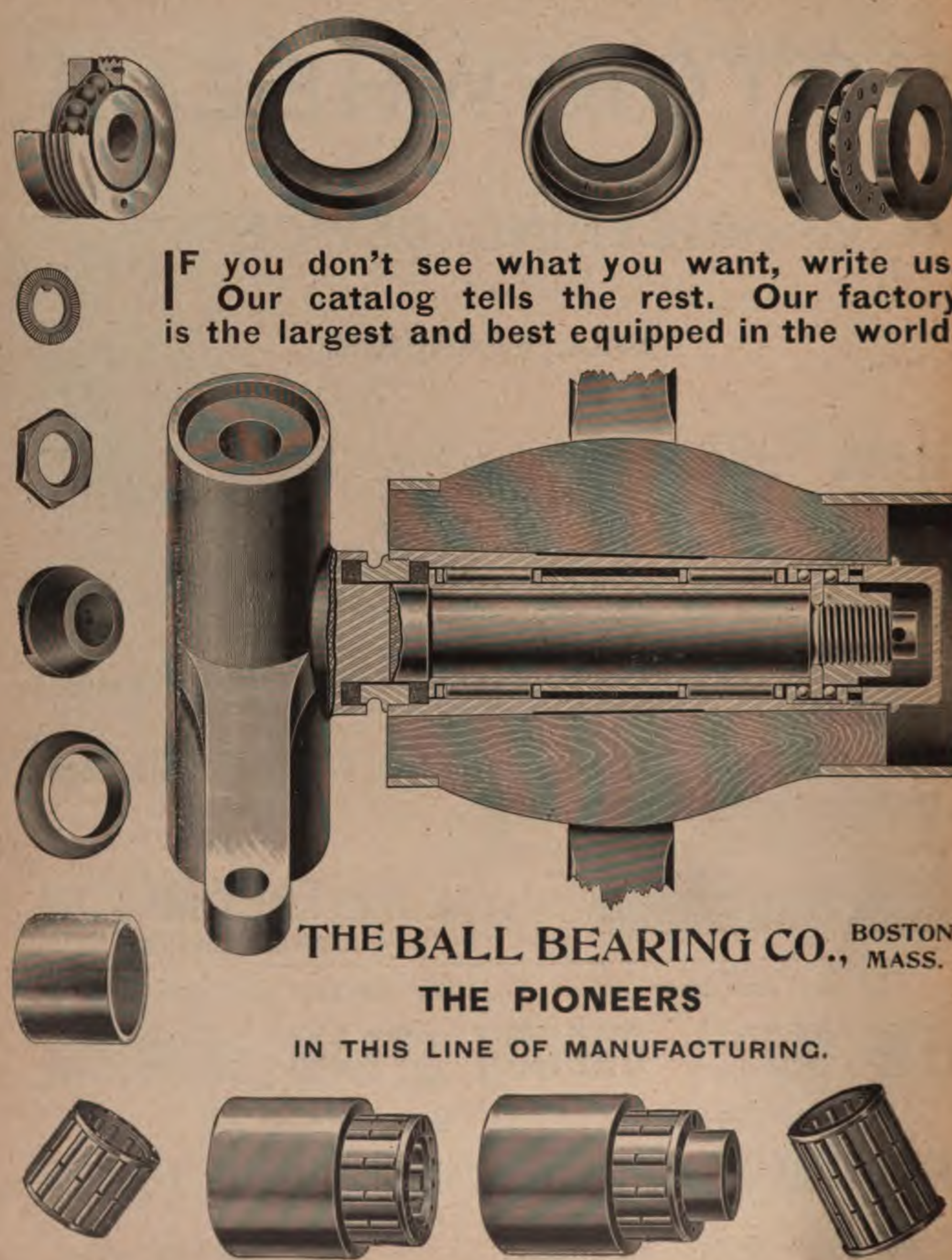
BACK NUMBERS.

We have no more complete files and have decided to offer miscellaneous back numbers of THE HORSELESS AGE, from December, 1895, to March, 1899, at the following prices:

12 Assorted, - - - $1.00
6 " - - - - 50 cents.
Foreign, 5 and 2½ shillings, respectively.

THE HORSELESS AGE,

American Tract Society Building, Nassau and Spruce Streets, NEW YORK.


IF you don't see what you want, write us. Our catalog tells the rest. Our factory is the largest and best equipped in the world.
THE BALL BEARING CO., BOSTON, MASS.
THE PIONEERS
IN THIS LINE OF MANUFACTURING.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS

VOL. V. NEW YORK, OCTOBER 25, 1899. No. 4.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

A Dollar a Pound.

It has come to be tradition among manufacturers that machines can be built at an average cost of a dollar a pound, and many manufacturers of motor vehicles are figuring on this basis. While as a general statement this may be approximately correct, it is questionable whether it is a safe guide in an industry so new and experimental as that of motor vehicle manufacture. As a precaution against uncertainties and incidental expenses and to allow for experimental work, which is absolutely necessary to success in any live manufacturing business, even in older lines, this estimate should be somewhat increased. In fact, it may be said without fear of contradiction that the danger which at present confronts the motor industry is not high prices, but low prices—too low for profit—and cheap quality, both of which mistakes must be rectified before the industry can be said to be on a manufacturing basis. The wild, haphazard estimates of the promoter and inventor will not serve as a basis for the prudent manufacturer who understands his business, wishes to establish a profitable trade and is not desirous of unloading worthless stocks upon the community.

Wheel Diameters.

The chaotic state of the inventive mind with respect to the proper diameter of wheels for motor carriages, which was commented upon in the early stages of the movement, seems to be disappearing, and an approximate standard is being arrived at, varying from 30 to 36 in. for wire wheels and 40 to 48 in. for wood wheels. Inasmuch as the wood wheel is generally chosen for rough roads, a larger diameter is properly adopted for this service. The smoother roads, where the wire wheels are chiefly used, do not require such large diameters. The tendency, however, is likely to be toward smaller wheels, securing greater strength and compactness, lower center of gravity and ease of access.

Air a Cushion.

The discussion that has been going on in our columns for some time past on the characteristics or properties of air, illustrates the necessity of strict definition in all scientific controversy, and shows how easy it is for us to call the same thing by different names and wander off into labyrinths of quibblings and sophistry, when if we would but take our bearings occasionally we would have no difficulty in keeping in line with our definition.

Air is a cushion under all gaseous conditions. Its cushioning value is lessened as its density increases, and finally disappears altogether in the liquid state. In the compressed

state, as in a tire or cushion, much of its elasticity is spent in resistance to the containing walls, the amount so spent depending on the rigidity of the resisting body. But whether the air is able to overcome that resistance or not, it is always seeking to regain its atmospheric form—i. e., tending to expand—and hence is under all circumstances a resilient body, yielding to shock or pressure, distributing that pressure throughout itself and to any resisting body and returning again to its original state when the pressure is released.

These discussions are of great value, and we hope we shall be similarly favored by our readers whenever occasion offers. We learn more by friendly criticism than by self-communion.

The Promoters' Gilded Dreams.

Promoters of large motor vehicle companies have been traveling over the country of late building mammoth factories in many of the prominent cities of the Union. The number of hands to be employed is generally given as in the neighborhood of 5,000, and these great factories are to be completed and in running order in a few months. This reads, no doubt, like a passage from the Arabian Nights, but its parallel is to be found frequently nowadays in our daily press, and will continue to be so long as we have the promoter with us. Like the poor of Scripture, is he to be always with us? We hope not. Certain it is that the longer he remains the more poor we shall have with us when he leaves.

Aluminum.

Little attention has been paid by American carriage builders to the lightening of motor carriage bodies. In France aluminum alloys have been employed in paneling for some time past with good results. This new metal is also available for dust-proof casing and similar mechanical parts where the metal is not exposed to a high degree of heat and weight can be saved without sacrificing strength. Several of our manufacturers are utilizing it in this way, but the carriage builder on this side of the water, we believe, has not yet adopted it. Perhaps our light, strong woods, so well fitted for carriage construction, are for many purposes as desirable as light metal, and render its use less essential here than in Europe.

Motor carriage builders who have not investigated the merits of aluminum should do so at once, as it is quite certain to be found preferable for some parts of the motor carriage.

Balanced Motors.

There seems to be a general desire for knowledge with respect to the possiblities of balancing gasoline vehicle motors, and we have accordingly engaged a well-known expert to prepare a paper on this subject, which will appear in a forthcoming issue. Any of our readers having ideas on this subject which they are willing to ventilate are requested to jot them down and send them in to add to the interest of the discussion. We will also undertake to have our experts criticise any designs in balanced motors which our readers may choose to submit.

First Club Excursion.

The first excursion of the Automobile Club of America is scheduled to take place on Saturday, the 4th of November. The details of the run are not yet settled, but it will cover a distance of about 50 miles, the rendezvous being the Ardsley Casino where the inner man can be well provided for and the necessary supplies for the machines obtained.

On such outings there is always danger of excess of enthusiasm, ending in promiscuous racing detrimental to the cause and a menace to the safety of the participants. A little speeding under proper circumstances is exhilarating and pardonable, but the mad dash and even the friendly brush of the speedway have no place on the common road. In these matters a bad example is quickly followed, and the marshals of the day, if so they may be termed, should see to it that moderation is the watchword of the outing. It is easier to start right than to be set right after we are on the wrong track, and in respect to speed and road usage the members of the club have a precedent to establish, which every sincere friend of the cause hopes will be as wise and considerate as was counseled by the worthy acting president, Mr. Chamberlin, in his introductory remarks at the last meeting.

Steam Boiler Number.

We wish to make our Steam Boiler Number as complete as possible in its treatment of this new phase of the subject, and to that end invite correspondence from any of our readers who have made a study of vehicle boilers and feel competent to treat them from some instructive point of view. We hope to make this number extremely valuable to investigators of the different motive powers and shall follow it with an Explosion Motor Number, in which this type of engine will be rather minutely analyzed in its bearing on the motor vehicle problem. The limitations of the storage battery are now quite generally known.

The Other Side.

The motor vehicle has been coddled too much. To fit it for the rough work it has to do it needs a little rough handling.

It is destined to be a very useful, in time even an indispensable machine; but it is not all poetry and loveliness, as promoters and boomers would have the public believe. At present it is a decidedly imperfect machine, requiring considerable patience and skill to master, and capable of improvement in every respect. Sensible people recognize this and allow for it; but the great body of the public, whose imaginations have been fired by the glowing prospectuses of promoters, must find it out by experience, and disappointment is a severe teacher. If these palpable defects in the motor vehicle continue to be glossed over and ignored, we shall be all the longer in correcting them; but if they are treated in a fair, critical spirit thought will be stimulated and they will soon be overcome.

It is the aim of The Horseless Age to give full and accurate technical and commercial information and dispel as far as possible the distorted and visionary ideas which have been fostered by the promotion period. Hence we propose to look at the other side, too, catering not to promoters, but to engineers, manufacturers, users and students of the subject.

Lead Cab Funerals.

Poets have always associated lead with sorrow and mourning. Hence there is rare propriety in the announcement that the Lead Cab Trust is going into the funeral business in Mexico. The Mexicans, it seems, use the street cars as hearses. The Lead Cab Trust will do way with these and substitute up-to-date lead cabs with storage battery coffins. Inasmuch as the trust's principal business here has been carrying "dead weight," they are well prepared for the funeral business in Mexico. The promoters themselves might act as chief mourners.

Lead Cab stock is on the decline in Wall St. The promoters are straining every nerve to hold it up, but it is growing heavier every hour. When it finally does fall it will splash them all with mud.

The Wilkins Automobile.

The first carriage built by the Wilkins Automobile Co., of San Francisco, mention of which was made in these columns of a recent issue, will be on the road in a few days. It is a 12-passenger wagon of the general shape and appearance or the ordinary hotel 'bus, with the flat roof. It is designed for general touring, and it is the intention of Mr. Wilkins, the inventor, with four others, to make a transcontinental trip as soon as the vehicle has been tried and proved road worthy.

There are several novel points which were devised by Mr. Wilkins. Steering and change of speed are accomplished electrically by means of a manual of four buttons placed so as to be convenient to the dirver's hands. The steering is effected by means of a movable block, which travels on a screw, on the end of which is mounted the armature of a small motor. By pressing the right-hand button on the manual, the motor is revolved in such a direction as to cause the vehicle to turn to the right. On pressing the left-hand button, the motor is reversed, causing the wagon to turn the other way. Change of speed is effected by means of a wide belt, which travels upon two cones placed on the same shaft, with their inclined faces toward each other. By separating the cones the belt slips down toward the points, giving a slow speed. By driving the cones together the belt is forced up the incline on each cone, this increasing the speed without jerk or jar. The cones are moved in the same way as the steering hub, by means of a screw, on the end of which is mounted the armature of a motor. But one lever is used. When set in the center notch of the sector the engine is thrown out of gear; when in the forward notch the vehicle moves ahead; when in the rear notch it moves back.

A dynamo of considerable power will be carried, and a search-light of 65-candle power will be mounted in front, as it is the design of the tourists to travel day and night when they once start across the country, hoping to make the trip in fifteen days. The water tank is carried under the driver's seat, and the gasoline tanks, of which there are two, are situated under the side seats, which extend the full length of the vehicle. Under these side seats are located storage hampers, with ice chests, to be used for the preservation of the food carried on the trip. A heavy hair cushion is strapped to the roof, and at night this is let down, falling flush with the cushions of the seat, thus forming a bed, in which a number of the passengers may slumber while the others guide the carriage.

The motive power is a 12 h.p. gasoline engine, having three cylinders with cranks set at 120 degrees. Each cylinder can be made to act independently, so that a breakdown of one cylinder will not stall the machine. As every part is interchangeable, should a breakdown occur the damaged part is taken out and replaced by a new one, the machine, in the meantime, running with the remaining cylinders. The machinery is carried on a frame entirely independent of the bed of the wagon, so that little vibration will be transmitted to the passengers, and plenty of room will be given for the machinery.

The company has already secured orders for several vehicles, one of which is to be used on the sand deserts of Nevada.

The Foster Steam Carriage.

Foster & Co., piano manufacturers, of Rochester, N. Y., are about to put on the market a steam carriage weighing 800 lbs. The wheels will be either of wire or wood, 32 and 34 in., respectively. A liquid fuel, water tube boiler tested to 1,000 lbs. pressure and a 5 h.p. engine of the marine type will be employed. The boiler tubes are of seamless drawn copper with steel heads, and piano wire is wound around the boiler as in the case of the Stanley boilers already on the market. They will manufacture all parts except the wheels.

Continental Automobile Company.

At the closing of the books on Saturday, Oct. 21, over 12,000 shares of stock had been subscribed for in New York and the different cities where subscriptions were received.

The National Carriage and Harness Dealers' Convention.

AXLES AND TIRES.

Skeptics on the ball or roller bearing and rubber tire question would have their doubts removed by a visit to the exhibition held at the Grand Central Palace, New York, last week, in connection with the National Carriage and Harness Dealers' Convention.

Among the exhibitors of ball or roller bearings were the Chicago Screw Co., the Grant Axle and Wheel Co., the Empire Ball Bearing Co., Buchanan, Knipe and the Meeker.

Rubber tire manufacturers were still more numerous, comprising the Diamond Rubber Co., Goodyear Tire and Rubber Co., B. F. Goodrich Co., Morgan & Wright, International Automobile & Vehicle Tire Co., Consolidated Rubber Tire Co., Revere Rubber Co. and the Victor Rubber Tire Co.

The International Co. exhibited their new "Apex" pneumatic tire for motor vehicles, and the Sectional Tire, now made in larger sizes for motor carriages.

The Diamond Rubber Co. showed their well-known Diamond Motor Pneumatics, and the Goodyear Tire & Rubber Co. a new line of solid and pneumatic tires for motor vehicles.

WIRE WHEEL AND HUB STEERING DEVICE.

The Weston-Mott Co., Utica, N. Y., manufacturers of wire wheels for motor carriages, exhibit a new motor wheel and steering device combined, which is of very neat and substantial construction. The fork of the steering device is a forging and the cones are screwed down through it. The cups are inserted in the central forging, which has two arms, to one of which the rods from the steering lever are connected, while the other constitutes the spindle for the hub of the wheel. The cones are hollow and through them passes a ½-in. binding bolt with lock nut, which binds the forks and gives solidity to the parts.

The device is dust proof and is adjustable in the usual manner through the cones. The weight of the entire wheel and steering apparatus, which is intended for a 1,500-lb. carriage, is 35 lbs., with 3-in. pneumatics.

Another new departure which they have made is seen in a flaring edged rim to prevent rim cutting of pneumatic tires.

THE MOTOR WHEEL.

A mechanical horse is shown by the International Motor Wheel Co., of New York City. It is a single powerful wheel supporting a gasoline motor and attachable with little change to any business wagon after the forward truck has been removed. The two-cylinder motor is hung on one side of the wheel, while on the other side are two small gasoline tanks of cylindrical form. No water jacket is used, the longitudinal radial ribs extending more than an inch from the cylinder on all sides. The drive is from a pinion on the motor shaft to a gear on the motor wheel. A friction clutch throws in and out of gear and a hand wheel governs the steering.

The motor wheel shown, which is attached to an ordinary delivery wagon, carries a 3½ h.p. motor and weighs about 350 lbs. J. W. Walters is the inventor and patentee.

MINOR MENTION.

Rand & Harvey, Lewiston, Me., have built a motor carriage.

Automobiles are now admitted to certain drives in Fairmount Park, Philadelphia.

A. O. Lombard, an inventor, of Waterville, Me., has built a steam carriage, which he is perfecting.

Geo. E. McElroy, 340 East Market St., Elmira, N. Y., has patented an automobile and will manufacture it.

The Keystone Match & Machine Co., Lebanon, Pa., are testing a new steam carriage of their construction.

Quick & Co., Paterson, N. J., bicycle builders, will manufacture automobiles under patents owned by Mr. Quick.

Press dispatches announce the intention of the Woods Motor Vehicle Co. to erect a very large factory, this time at Buffalo, N. Y.

The Keating Automobile & Wheel Co., Middletown, Conn., are said to be filling a large order for electric delivery wagons for a big New York department store.

The People's Automobile Co., Cleveland, O., has been chartered with a capital stock of $50,000 to run motor omnibuses in competition with the street railways of that city.

A new San Francisco concern is the Sparks Automobile Co., capital stock $1,000,000. The directors are Chas. H. Taylor, W. J. Bartnett, T. J. Sparks, John Curtin and S. Goodenough, of Oakland.

J. H. Yale, traveling salesman for Trice & Co., wholesale paint dealers, of Newark, N. J., has been using a steam carriage on his rounds since August last with much success, even in the mountainous regions of Pennsylvania.

The Philadelphia Motor Carriage Co. has been incoproated with $1,000,000 capital to make and sell electric vehicles. The incorporators are C. P. King, Philadelphia, and J. T. McGraw, C. R. Durbin, F. H. Treat and Claude S. Jarvies, Grafton, W. Va.

The State Department at Washington is in receipt of a communication from U. S. Consul Halstead, at Birmingham, England, giving favorable testimony on the economy of motor work wagons, as demonstrated by the recent heavy motor trials in England.

Dr. O. P. Sook, of Newark, O., recently traveled from Baltimore, Md., to his home in a special steam carriage which he had had built for use in his practice by the Crouch Automobile Mfg. & Transportation Co., of Baltimore. The Doctor named his new carriage the "Kittie Clover," somewhat suggestive of Dobbin still.

The Old Dominion Motor Car Co. is petitioning for a charter to run motor vehicles in the city of Richmond, Va. The capital stock of the company will be not less than $100,000. Capt. Andrew Pizzinie, of Richmond, will be president, and the others interested are said to Be V. G. Robinson, of Philadelphia; J. F. Barry, J. P. Evans and Albert Davis, of New York.

LONDON NOTES.

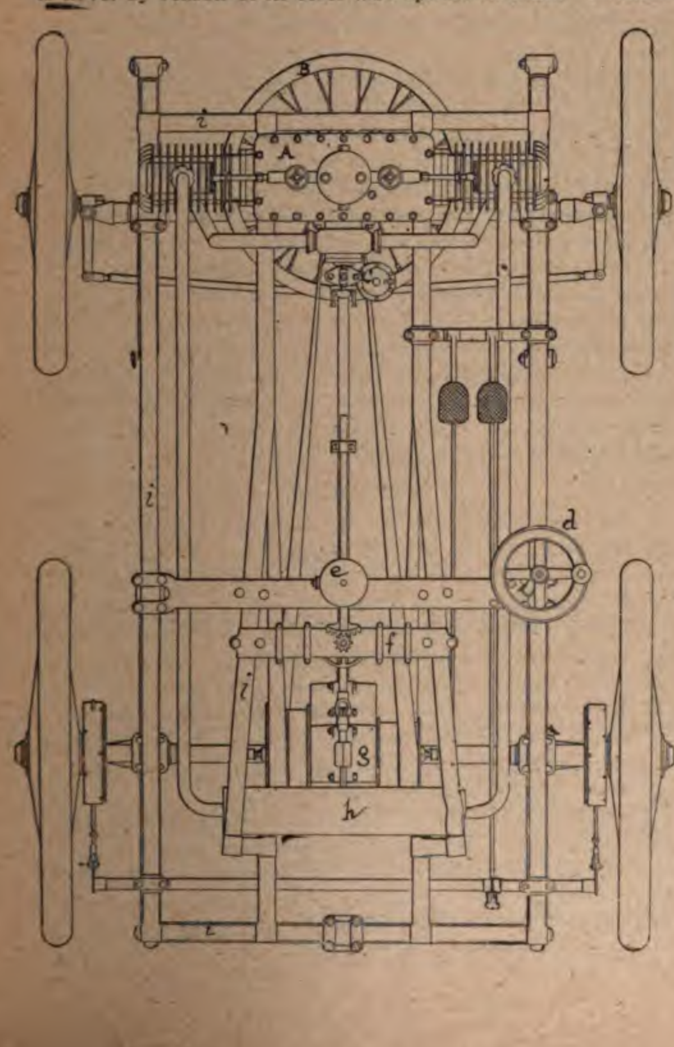
London, Oct. 12.

THE TARE WEIGHT OF HEAVY MOTOR WAGONS.

In the course of his paper read at a meeting of the British Association for the Advancement of Science at Dover, last month, Mr. Thornycroft, the head of the concern known as the Steam Carriage & Wagon Co., Ltd., drew attention to the drawback attending the limiting of the tare weight of heavy motor vehicles in the United Kingdom to 3 tons, considering it to be "the one and only obstacle now remaining in the way of the complete solution of the problem of steam on common roads." Probably as a result of Mr. Thornycroft's paper a conference is to be held on Nov. 15 between the members of the committee of the Automobile Club, the council of the Liverpool Self Propelled Traffic Association and the representatives of firms engaged in the construction of heavy motor vehicles to consider the advisability of attempting the introduction of a bill to raise the tare limit.

THE TURGAN & FOY MOTOR CARRIAGE.

I send you a drawing showing a plan of the motor and mechanism of the Turgan & Foy carriage, illustrated in The Horseless Age for Sept. 30. This drawing shows clearly the position of the motor and its horizontal fly wheel. The latter is novel by reason of its steel wire spokes or arms. I was in error in stating in my former description that the belts ran from the vertical shaft to a vertical countershaft at the rear. As will be seen, the latter is horizontal, the belts being crossed. In the illustration herewith A is the motor, B the fly wheel, C the carbureter, d the steering wheel, e the variable speed control handle, f the belt-shifting gear, g the balance and variable speed gear, h the silencer and i the tubular frame supporting the motor, etc.



THE ALLARD MOTOR CARRIAGE.

A NEW STARTING GEAR.

One of the drawbacks to the popular Benz carriages is the necessity of the driver having to dismount from his seat to put the motor in operation. With the view of overcoming this difficulty, Stadling & Plenty, of Newbury, near Reading, who hold the agency for these carriages in that district, have recently introduced a device whereby the motor may be started from the driver's seat. The patents not being all and fully completed, I am not able to send you full particulars of the device, but briefly stated it consists of a special pulley fixed to the fly wheel with an automatically acting ratchet, which engages when the wheel is pulled by a wire cord extending to the driver's seat, and is taken out of gear when the engine starts. The new starting device is claimed to be most effective.

ANOTHER RUN TO BRIGHTON.

A few automobilists in America will remember the memorable motor run from London to Brighton on Nov. 14, 1896, to commemorate the inauguration of the Light Locomotives Act, 1896. The Motor Car Club has this week issued an announcement that to celebrate "Emancipation Day" they will organize a run over the same route on Monday, Nov. 13. A banquet is to be held at the Hotel Metropole, Brighton, the same evening to celebrate the event.

THE BRAKE HORSE-POWER OF MOTOR VEHICLES.

In last week's issue of the Engineer there appears an interesting letter from John S. V. Bickford, of Camborne, Cornwall, a well-known maker of mining machinery, in which he makes a suggestion with regard to the testing of the brake horse-power of motor vehicles. As the question is an interesting one, I append an extract from the letter in question:

"Let a wooden platform be laid in the examination yard near a strong wall or post with a ring bolt in it sufficiently

strong to stand the utmost pull of the car to be tested. The platform must be quite level, and means should be provided to wet it to keep it from burning. Place the car on the platform and anchor it to the ring bolt. Now start the engines, and either jack up the weight off the driving wheels or add weight to them till they slip at the speed corresponding to the speed at which it is desired to test the horse-power of the car.

THE MC LACHLAN GASOLINE MOTOR.

I take it that the pull on the ring bolt, measured by suitable means, and multiplied by the peripheral speed of the driving wheels, will give the power given out at the rims. The platform or brake, being of wood, would not wear the tires and could be prevented from burning by water."

ENGINEERING FIRMS ADOPT MOTOR WAGONS.

I have already referred to the fact that Johnson & Phillips, electrical engineers, of Old Charlton, Kent, have lately put a "Lifu" steam wagon in service. I now learn that Vickers, Sons & Maxim, the great gun-making concern, of Erith, in the same county, are at present experimenting with a German-Daimler lorry of the type illustrated in The Horseless Age for July 26 last. The vehicle has a carrying capacity of 2 tons and has lately been occupied in the transport of war material between Erith and Woolwich Arsenal, with so far good results.

From Wolverhampton comes the news that a number of local gentlemen are contemplating the establishment of a service of motor omnibuses in the town. A motor car service has also just been started in Nottingham between Trent Bridge and St. Peter's Church, while at Ramsgate a Coulthard steam omnibus is about to be put in service.

HORSELESS VEHICLES FOR MUNICIPAL WORK.

At a meeting this week the vestry of the Parish of Chelsea adopted the report of its surveyor recommending that advertisements be issued for three motor vehicles, to be supplied under proper guarantees as to maintenance, cost of working, etc. Thus does another local authority give its support to the automobile movement.

DRIVING CHAINS FOR MOTOR VEHICLES.

Brampton Bros., Ltd., of Birmingham, have issued a large chart showing in full size the many patterns of blocks and roller chains for use on motor vehicles. The chart is useful, as it gives not only the various pitches and breaking loads of the chains, but also the dimensions of the rollers and blocks in the same. Messrs. Brampton have earned quite a reputation as makers of driving chains for automobiles, their products being almost exclusively used in England, and very largely in France, so that I am not "puffing" them too much in suggesting that constructors of motor vehicles in America would do well to obtain a copy of the chart, even if they did

not adopt Brampton chains. The information the chart contains would, I am sure, prove useful.

A new driving chain has lately been put on the market by Herr Robert Kaiser, of the Maschinenfabrik, Barmen, Germany. The chain is of the block type, the feature being the employment of a number of small steel pins, acting as rollers, between the rivet and the hole in the block, the maker claiming a reduction in friction and wear on the rivets. The blocks are of a special form, having a deep central groove, adapted to fit on a stumpy auxiliary tooth on the sprocket wheel arranged between the ordinary teeth. The rollers are not carried in a cage, as in the Mossberg and other shaft roller bearings, but are all in contact with each other. Provision for lubricating the roller bearing is made by the drilling of a small hole in each end of the block. A feature of the rivets is that although round in the center the ends are of an oblong shape and fit into correspondingly shaped holes in the links or side plates, the pins being in this way prevented from working loose. The Kaiser chain is made in a number of sizes and pitches, the latter ranging from 2 in. up to 5.8 in.

A GO-AHEAD CITY.

In previous letters I have referred to the go-aheadness of Newcastle-on-Tyne in matters automobile. The Newcastle and District Motor Car Co., Ltd., has already got about four Daimler cars running, and these have proved so successful it is proposed to increase the number to ten. The directors have also acquired land on which to erect a large corrugated iron building to accommodate no less than 30 vehicles.

E. J. Pennington, of the Pennington Motor Co., and H. J. Lawson, of the British Motor Co., have set out for America on business connected with the sale of the Pennington motor patents on your side of the Atlantic.

The Riley Cycle Co., Ltd., of the City Cycle Works, Coventry, is the latest Midland cycle concern to take up the construction of motor vehicles, they being at present engaged on the construction of a motor tricycle and a two-seated quadricycle. The Riley Co. have adopted the popular 2¼ h. p. De Dion gasoline motor.

QUESTIONS AND ANSWERS.

At the request of many of our readers we have decided to open a department of questions and answers. We will endeavor to answer any detail question in practical engineering pertaining to motor vehicles.

Mr. Schaum's Balanced Motor.

New Haven, Conn., Oct. 21.

Editor Horseless Age:

It would require a good deal of space to treat properly of all the misconceptions exhibited in Mr. Schaum's motor design. The main points, however, may be outlined as follows:

1. The vibration of a motor has nothing to do with the speed of the fly wheel. It is due to two things—the inertia of unbalanced reciprocating and rotating parts and the reaction of the engine from the irregular torque applied by the explosions to the shaft.

2. As Mr. Schaum's pistons move in and out together, and have no equal and oppositely moving parts or weights to balance them, they will shake the motor as badly as the piston of any single-cylinder engine. If the cranks are unbalanced their centrifugal force will be added at the ends of the strokes to the inertia of the pistons.

3. The advantage of the oppositely rotating crank shafts, in balancing the torque, is apparent rather than real. Both are geared to one work shaft, and the engine frame will merely react about the latter instead of about the individual crank shafts.

4. An additional defect is due to the fact that the crank shafts alternately accelerate the fly wheel and are pulled by it. Owing to this, any backlash in the gears will result in noisy action and rapid wear.

It would be thought curious indeed that after "at least a dozen" attempts any one should have arrived no nearer to a correct solution of the problem, were it not that so little attention is paid to the balancing of engines outside of the marine branches. Balanced action is quite as desirable in a carriage as in a steamship, but the literature of the horseless vehicle is yet mostly in ovo, and the experimenter must needs acquaint himself with mathematics and dig out his information from abstruse treatises on the high-speed steam engine. To any one who can understand or at least apply the formulas there to be found, a few dollars thus invested will result in an incalculable saving of time and coin.

HERBERT L. TOWLE.

To Silence the Exhaust Without Choking Engine.

Youngstown, O., Sept. 25.

Editor Horseless Age:

Please give description of muffler which will thoroughly muffle the exhaust of a 6 h.p. engine the primary exhaust of which discharges into a 2-in. pipe and the secondary exhaust into a 1½-in. pipe. The engine has a 6-in. stroke. The area of the piston is 5½ in.

The difficulty has been to get a muffler which would silence the exhaust without choking the engine.

THE FREDONIA MFG. CO.

To "thoroughly muffle" the exhaust is no easy task, and, as a general thing, is a compromise at best.

Would suggest that the last length (furthest from engine) of exhaust pipe be slotted through from end to end. The cut through the wall of pipe can be easily done on milling machine or planer. Replace the length of exhaust pipe and cap the outer end. This is a simple expedient and has been successfully adopted where gas engines have been in close proximity to residences. The width of slot through pipe is found determined by experiment, the idea of course being to pass the exhaust through a long narrow opening several times the area of the bore of pipe.

We shall publish, in the near future, an article dealing to some extent with this matter; in the meantime we trust our friend will try the foregoing plan and report fully.

R. I. C.

The Jump Spark in the Lead.

Coden, Ala., Oct. 11.

Editor Horseless Age:

What are the objections and difficulties, if any, in the way of an electric sparking device having fixed platinum electrodes in combustion chamber? Will such a device work as satisfactorily and economically as the wipe spark, all things being equal?

D. R. L.

Note the answer to G. G. C., page 15, Oct. 11, 1899. The well-known De Dion and Bouton, as well as the Benz, motors use fixed electrodes successfully. The question as to the best form of iginition device resolves itself purely into a choice of evils with, we understand, the jump spark in the lead so far as the total number of sparking devices on vehicle motors is concerned.

R. I. C.

An Eight Cylinder Idea.

Rochester, N. H., Oct. 12.

Editor Horseless Age:

Inclosed I send you a plan of a gasoline motor that I would like you to look over and tell me if such a combination might be practical.

I have been led to consider the need of such an engine by a conversation I had some time ago with a gentleman that had been driving an automobile through the New England States advertising a patent medicine this summer. The automobile he was driving was a one-cylinder four-cycle motor of 8 h.p., and styled to be free from noise, vibration, odor, etc.

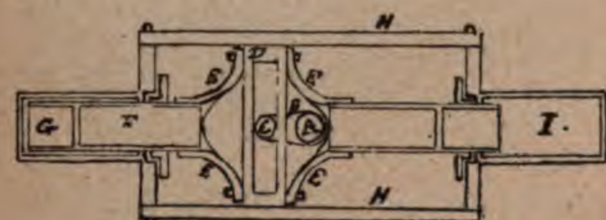
The noise was such, I was told, that conversation was almost impossible while on the way, and the vibrations told so much on his nerves that he was glad when the motor broke down and the automobile had to be sent back to the maker. Furthermore, he told me that in spite of the water jacket the motor heated so that he was often obliged to stop on the way to let it cool down.

It is evident that there is too much work for one cylinder.

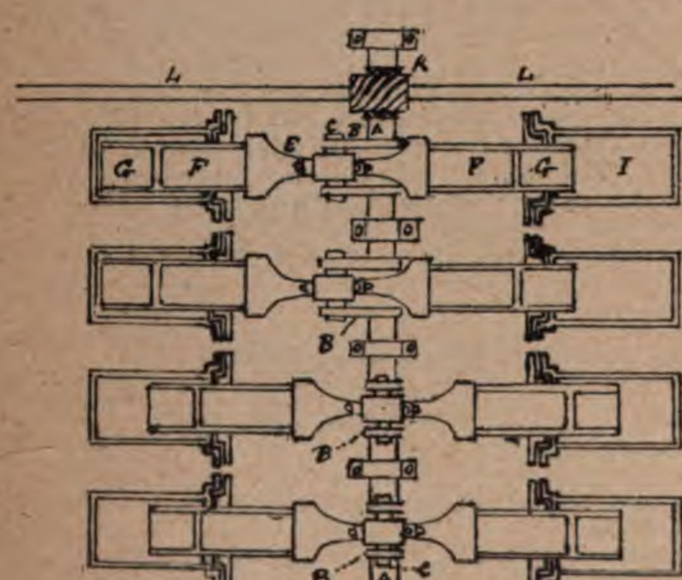
To make an engine with eight cylinders seems complicating things beyond reason, and it seems also that the liability to break down will increase in proportion with the number of cylinders; but when one considers the light work that is given

to each cylinder (after each quarter of a turn the working cylinder is relieved by another one), and the low speed at which the engine can be operated, one can see that the danger of breaking down is pretty well averted.

The question of weight might also be considered. The increase of weight would not be very large, as the fly wheel could be reduced a good deal, the gearing entirely suppressed and the base plate shaft, etc., not having to bear so much strain ...ven time, could be made lighter for a given horse-power than with a single-cylinder engine, not speaking of jackets and water.



Side View



Engine seen from above. The spiral gear at the bottom of the picture is omitted.

A—Motor shaft.

B—Crank.

C—Crank pin.

D—Slide for the crank pin.

E—Links connecting the crank pin slide with hollow trunks that take the place of pistons.

F—Hollow trunks divided into two unequal parts; part G is used as compression space. These trunks almost fill the cylinder, leaving only a small free space between them and the cyl? inder.

H—Links or slides uniting the two opposite cylinders.

I—Cylinders unpolished inside and flanged on the outside so as to give better radition of heat.

K—Spiral gear.

L—Eccentric shaft turning half as fast as the motor shaft.

A cylinder costs generally pretty high, on account of the borings, but the cylinder I have got in view, and of which I make here a rough drawing, ought not to cost much.

It is simply a rough casting ribbed on the outside; instead of a piston a hollow trunk that fits snugly in the packing of the cylinder, but does not come in contact with the walls of the cylinder, leaving a small free space all around it (I think such a disposition could be used in engines of small size). This trunk being strongly linked with the other one opposite to prevent any wabbling, and being opened at the end near the shaft, would help the cooling of the clyinder. With this disposition the only friction would be that of the trunk on the packing of the cylinder and no oiling inside.

The advantages of such a cylinder could be resumed so: Cheapness, no oiling inside, radiation of heat from the whole surface of the cylinder at all times, this radiation being rendered more efficient by the unpolished inside of the cylinder; radiation of heat from inside the trunks, especially when in motion.

An engine of this description, with trunks 2 in. diameter and at stroke of 4 in., would take a floor space of 25 x 25 in. and be equal in power to a one-cylinder engine with a piston surface of 25 in., or pretty near 6 in. in diameter, with a stroke of 4 in. Of course this engine can be made reversible, and by the addition of a reservoir for compressed air fed by a special pump we can make the motor self-starting. That compressed air can also be used to send a current of air to cool the engine by the means of an injector. Yours, etc.,

ERNEST DUVAL, M. D.

The communication is so suggestive and covers so wide a field that we commend it to the attention of our readers, and, for the present, refrain from extended comment.

We take it as a very encouraging sign of the times when a medical man, one of the class likely to be early in the automobile market, exhibits such a keen and thoughtful interest in motor design, and we trust the several points will receive the attention and helpful criticism they merit.

R. I. C.

The price of gasoline is rapidly increasing in France, owing to the increased consumption in motors and the disposition of the large refineries to anticipate this consumption. The raise is said to be 5 centimes a liter, which cuts down the profit of the dealers and is regarded by the chauffeurs as a serious menace to their pleasures.

LESSONS of the ROAD.

Users of motor vehicles are invited to contribute to this department for the good of the industry.

The Equine Mine Analyzed.

Boston, Mass., Oct. 18.

Editor Horseless Age:

My experience on the road in my new steam motor carriage has been so especially enjoyable that some account of it may be of interest to readers of The Horseless Age.

After the first few miles of steep hill-climbing, testing the power and manageability of the innovation in a most successful manner, I was soon led to notice the impressions evidently produced in the mind of the horse. Some minds jogged on, evidently tired and worn with days and years of drudgery and no hope of green pastures. These barely noticed that my blank dashboard was there at all. They thought of barn and hay and longed for rest—pathetic pictures. Others, young and brisk, with eyes alert, eager for some exercise, seemed astonished at the mere absence of a horse. What! four wheels and a dashboard and no noble animal? I often stopped to apologize—not that apology was necessary, but that I was considerate of their feelings. The effect was often magical and extended to their drivers and owners. "Thank you, sir," "I thank you," greeted my ears as family carriages with dashing spans passed by.

In return for my evident desire to allay their fears, a corresponding effort was made to accustom the horse to the novel sight. In every case the drivers seemed to feel that the motor carriage is to be universally welcomed. In fact, my greatest enjoyment has been in feeling that each person I met was a friend. It is very evident that even such little courtesies along the way can do much to harmonize and reconcile both horse and man to the motor.

While I have encountered no unmanageable horses or runaways, and no accidents have occurred, I have been much interested to determine the cause of alarm, shown in about 10 per cent. of average horses one meets on the road. At first the slight noiseless escape of steam seemed an explanation, but I have since noticed the same average symptoms of alarm when moving down grade or standing with no escape of steam whatever. The experience of hydro-carbon and electric motor drivers has, I think, been about the same.

Conceding a large measure of intelligence to the horse, it doubtless seems odd in his mind that a vehicle on the highway can move without his assistance. Possibly some of this feeling in a man would be conceit. I think, however, that henceforth special training of the horse will receive more attention. For the public safety a horse alarmed without some reasonable cause will hardly be allowed in crowded thoroughfares—certainly not to the exclusion of the much safer and more manageable motor vehicle. Very sincerely yours,

W. P. KIDDER.

The Other Side.

Dowagiac, Mich., Oct. 20.

Editor Horseless Age:

You are asking for experiences of the road, and I attach a clipping that was sent me by a friend which describes my own experience so well it could not be improved on. My seven days' traveling, however, was not done on consecutive days, as the motor always had to rest from one to three days after a few miles run before it could be persuaded to operate again. I purchased the carriage for the reason that I could not make my own temper harmonize with the natural disposition of horses and thought that at last a motive power had come that man could boss with some degree of satisfaction, but found that driving the most unreasonable, lazy and ignorant horse is simply heavenly as compared with trying to start a gasoline engine on a hot day. I know that there are some who have succeeded in mastering the intricacies of the combination that is always alluded to by our country cousins as "that thing," but I will have to be classed with the "also rans."

Yours for better days,

A. B. GARDNER.

The clipping alluded to reads as follows:

Following is an automobile diary:

"Monday.—Beautiful start. Thousands saw us off. Lovely day. Roads admirable. Broke a hub at Bunkersville. Total distance for day 9 miles.

"Tuesday.—Didn't get away until 3 p. m. Road up hill. Had to get out and push. Lost the monkey wrench. Made 4 miles.

"Wednesday.—Raining. Started between showers. Soaked. Lost one of the lamps. Stalled in a ditch. Distance traveled, 2 miles.

"Thursday.—Nice weather. Road heavy. Up grade. Broke an axle. Had to send for new one to Skipperton. Made 3½ miles to-day.

"Friday.—Got early start. Covered 4 miles in 2 hours. Broke off the dashboard, ripped out the seat, smashed the eccentric and lost the oil can.

"Saturday.—Tinkered up the machine. Started late in afternoon. Down grade for 2 miles. Machine ran away. Busted everything that wasn't previously busted. Spent 3 hours gathering up fragments. Have covered 21½ miles since Monday morning—much of it on foot.

"Sunday.—Rest."—Cleveland Plain Dealer.

Studies in Electric Ignition.

By Viator.

Part 2.

The articles appearing in your journal from time to time upon this subject lead me to think it well to continue the discussion more broadly than my first paper intended.

It may be broadly stated that there are an infinite number of ways to provide a perfect electirc ignition. On the other hand, it is painfully evident that the average inventor is content to use about the first one of these many which comes into his head, and this utterly irrespective of the questions, Will it keep in order? Can it be easily reached for examination and repair? In this latter respect it does not differ from many other questions in motor carriage work—a point often forgotten.

Let us examine into the various points which insure a true automatic action of an electric ignition device. First, moving parts must be few in number, must move as slowly as possible and through as small a distance as possible. Second, moving

parts should not be subjected to great heat and should be so situated that they may be economical and adjusted while the engine is in motion. Third, insulating material should be stationary and not on the moving parts, and should never constitute in itself a bearing for a motive part. Insulating material should be unaffected by heat, oil or by water, and should be as strong mechanically as possible. Fourth, all parts should be silent.

Now that we have gone over the rules of the game, how shall we best accomplish the result?

Electric ignition divides itself into two forms—that accomplished by means of a secondary or Rhumkorff coil, giving the "jump spark," and that in which the one-wire coil is used, giving the breaking or wiping spark. (Both these coils are induction coils, so that this name is not used, to avoid confusion.)

Both methods have their advantages and disadvantages.

The method with secondary current, as furnished by the Rhumkorff coil, is on the one hand more silent and adapts itself more readily to the changes in the relative position of the spark and piston, which are now showing such advantages over the old form, in which the spark always came at or about the time of the dead head. It does away also with all necessity for moving parts in or near the cylinder. It is more silent, as the parts do not have to move so rapidly, and for these same reasons the parts last longer and there are fewer of them.

The secondary or jump spark, however, is not by any means so easy to handle. The insulation must be far more perfect, and even then in damp weather the spark will run along the surface of the external parts and thus avoid the required "jump" in the explosion chamber. Added to this, the points in the cylinder between which the spark should occur will become either at their tips or their bases covered with deposit, which, acting as a conductor, again destroys the spark. Most of the various Rhumkorff coils, moreover, require a "vibrator" in the primary current, which constantly gets out of order. These troubles, bad enough with one cylinder, become worse when two are in use, and the commutation becomes more complicated in consequence. This form of coil, as a rule, requires a battery and does not, in my experience, work so well with a dynamo, so that for automatic use both battery and dynamo may have to be used, the battery to run the coil steadily and at starting and the dynamo to keep the battery full (of which more later).

Now for the disadvantages of the primary coil, giving wipe or break spark. (Under this head I may include those forms of dynamo which are themselves their own coil.)

In this form the coil gives little trouble, as it contains no moving parts, and it is easily disposed of. It is in the cylinder that the trouble comes. Here the wipe or the hammer must move, actuated by a part of the engine, such as the piston or a cam on the engine shaft. It must be returned to its former position by a spring, and all these moving parts must move quickly with a sudden motion and under the heat effect of the explosion. Now comes in the factor of noise also, as these hammers, etc., must rise and fall with a sharp motion easily heard in some carriages at 50 yds. or more in the country. The violence of the impacts wears out the hammer, the anvil and the insulation between the same and the frame of the engine. In addition to this, it is not easy to make the sparks at a variety of times in relation to the engine cycle, and this is of rapidly increasing importance.

OUR FOREIGN EXCHANGES.

Aluminum in Carriage Building.

Aluminum is extremely ductile, and one of the easiest metals to work under the rolls; in fact, rolled sheet one-thousandth of an inch in thickness is much used for beating into leaf for purposes of decoration, silver leaf having been entirely driven out of the market, as the former metal has the advantage of not getting tarnished. Sheet metal up to No. 8 S.W.G. can be bent cold and treated generally in the way brass and copper are. For panelings this sheet will be found invaluable, especially so where single sweeps are concerned. In the case of double sweeps or dome shapes, such as are required for the roofs of broughams and hansoms, it will be found that those accustomed to this class of work will find little difficulty in hammering the sheet into the desired form, though this process must always take more time, and be, therefore, more expensive, than dealing with simple curves. Of course, if a great deal of similar work has to be turned out the cheapest way would be to stamp the curves in the sheets with steel dies, which would be a considerably cheaper process than that of shaping and working up curves on built-up material intended for a roof or other curved part. In order to give sufficient rigidity to panels made in such a way cross ribs, supports or shaped bearers must be provided at intervals, against which the curved sheet will bear, and these bearers may well be of cast aluminum of slight section, having ends bolted to an aluminum or wooden framework. Sheet aluminum panels may be fixed either to a frame cast of the same metal, or one of wood. In the former case, a very secure method of fixing the panel is by rivets; it must be borne in mind, however, in riveting aluminum sheets, that the metal is so malleable as to have a tendency to elongate if the rivets are close to the seam. The rivets should consequently be slightly smaller than the holes. Another method of dealing with panels which is coming into vogue on the Continent is to stamp or hammer the panel in such a way that a bead or frame is formed along the sides from the sheet itself. By carefully burnishing this bead or frame and painting the panel a most pleasing effect is produced. It may be useful to note here that the favorite method of burnishing aluminum is to employ the ordinary bloodstone or steel burnisher, which must be dipped in a mixture of equal weight of olive oil and rum, shaken together in a bottle until an emulsified consistency results; the treatment is then similar to that of burnishing silver, care being taken not to press as hard as would be the case with the latter metal. The Americans obtain a most brilliant finish by simply using a piece of soft wood soaked in olive oil, with which the grain of the metal is filled up. Great saving is effected in using aluminum sheet for the panels and roofs of such vehicles as broughams or hansoms, in that there is no necessity for any hide to be pasted on. A very slight amount of "filling up" is required before painting, while only half the usual number of coats of paint will be needed. The sheet metal, if properly prepared by "frosting," will be found to take and adhere to the paint in a most satisfactory manner. This essential "frosting" is carried out in the following way: The sheet to be treated is dipped for 15 to 20 seconds in a hot bath prepared by taking 10 per cent. of caustic soda, diluting it with cold water and saturating with about 2½ per cent. of common salt in an iron vessel. The solution must be heated but not boiled. The surface of the sheet, which will have become nearly black, and covered with air bubbles, must be

washed in an abundance of cold water by the aid of a fiber brush, then again dipped and washed, and finally placed in an earthenware vessel containing concentrated nitric acid until the metal has become quite white; after this, washing in cold, running water and drying in warm, fine sawdust will complete the process. If this dipping is carried further a very pleasing matt is given to the surface, which will keep indefinitely. In building up the framework of carriages, aluminum may be used with advantage, either in castings or in the rolled state, in channel, T or other suitable sections, having a strength of from 16 to 20 tons per square inch, the various parts being bolted together, care being taken that where metal joins metal a piece of leather or equivalent material is interposed between the two to absorb vibration. Where an electrical plant is available, a most effective method of joining parts is by electrically welding them, a comparatively easy process with aluminum if due precaution is taken. Greater use will undoubtedly be made in the future of soldering for joining aluminum parts together and to other metals. At present, however, though hard and soft solders are both available, great care must be exercised on the part of the manipulator in effecting a thorough job. The difficulty to contend against is that immediately on exposure to air a slight film of oxide forms over the surface of the metal, which, though arresting any further corrosion, at the same time entirely prevents the aluminum being, so to speak, "tinned." It is essential, therefore, to expose a fresh surface of metal only when covered by the molten solder. Among others, the British Aluminium Co., Ltd., to whom I am indebted for having kindly assisted me in obtaining data for this paper, have a special solder for this purpose. Their instructions are to clean off all dirt and grease from the surface of the metal with a little benzine, apply the solder with a copper bit, and, when the molten solder is covering the surface of the metal, scratch through the solder with a little wire scratch brush. By this means the oxide on the surface of the metal underneath the solder is broken up, and the solder, containing its own flux, takes up the oxide and enables the surface of the aluminum to be "tinned." The bodies of motor carirages have frequently to withstand very considerable strains, and, in order that their appearance may not be prejudiced by the provision of the necessary strength, the metal tubes or girders are so intermingled with the body as to form part of the lines of same. Aluminum has been used under these conditions with considerable success; its low specific gravity (2.6 rolled) is of immense importance where self-propelled vehicles are concerned.

Either at ordinary temperature or at red heat aluminum is less affected by try or damp air than any other industrial metal * * * It will retain electro-plating very satisfactorily, though it has been found that the process cannot be carried on under quite the same conditions as in plating other metals; for instance, the acid in the bath must not be capable of dissolving aluminum, but at the same time should be able to oxidize any hydrogen developing in a nascent state on the cathode. In plating aluminum with silver it is desirable to first cover the metal with a coating of copper.—Autocar.

The Musker Automatic Liquid Fuel Burner.

This burner, which is being introduced by Messrs. Musker, a large firm of mechanical engineers, of Liverpool, England, who are actively taking up the manufacture of heavy motor vehicles, contains several features of novelty and originality. The burner is of that class known as a vaporizer or gasifier, and it is combined with a steam generator, so that the oil (liquid fuel), water and air are all supplied according to the quantity of hear or steam required—i. e., in relative proportional quantities, or nearly so; the variation of quantity being effected by the pressure of steam, and the proportion of supply being effected by a small motor driven by steam from the generator. Thus, if, when running, steam is cut off from the main engine of the vehicle, and the pressure of the generator exceeds the normal pressure, this acts through a valve or goveronor device, so as to govern the speed of the secondary supply or controlling engine.

With regard to the vaporization and combustion of the oil, all the air required to support combustion of the fuel is supplied by a blower or air pump, so that the proportion of air to oil is positive, and is kept constant.

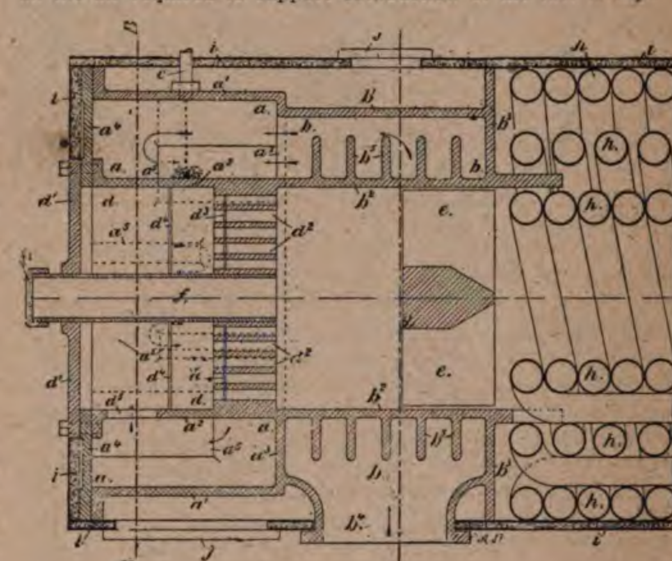


FIG. 1.

This air is heated to a very considerable temperature, and is then in this condition delivered to the oil vaporizer. The heat of the air assists in the effective vaporization of the oil, and mixing with it the two pass together to the burner apertures.

The burner portion proper consists of a plurality of small holes or nostrils, bored through a block of metal of some considerable thickness; and are preferably so proportioned in relation to the volume of gaseous fluid that the pressure behind or within the burner apertures or nostrils is small and the velocity of issuance comparatively low. This obviates noise, and the supply being continuous, back firing is obviated.

In front of the nozzle flames is an obstruction or baffle in the form of a heavy metal grid, which assists in breaking up the flame and prevents too great a velocity of flame jet. Inside the burner, usually at the entrance of the flame holes or nostrils, and within the chamber behind or within them, there are provided diaphragms of wire gauze to assist in preventing back firing, which might possibly happen under special conditions of disturbance.

The oil vaporizer is so constructed that the oil is free to flow over a heating surface from the point at which it is introduced, until the whole is vaporized.

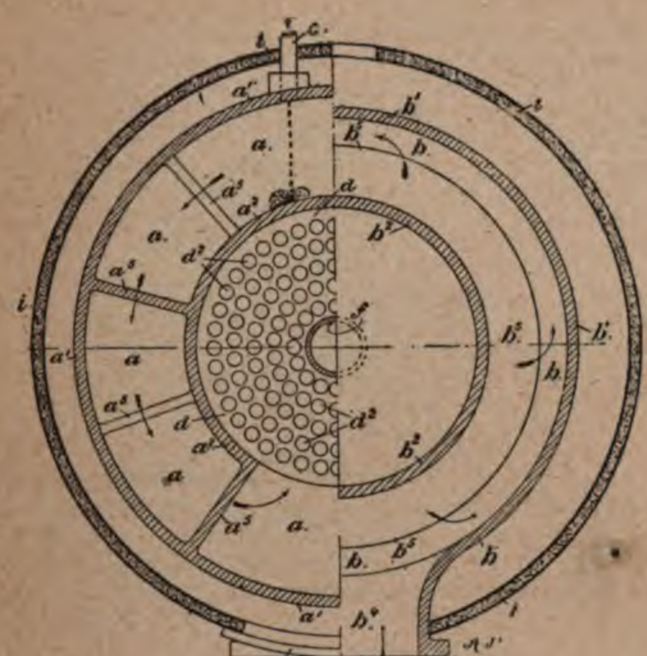


FIG. 2.—Cross Section of Burner.

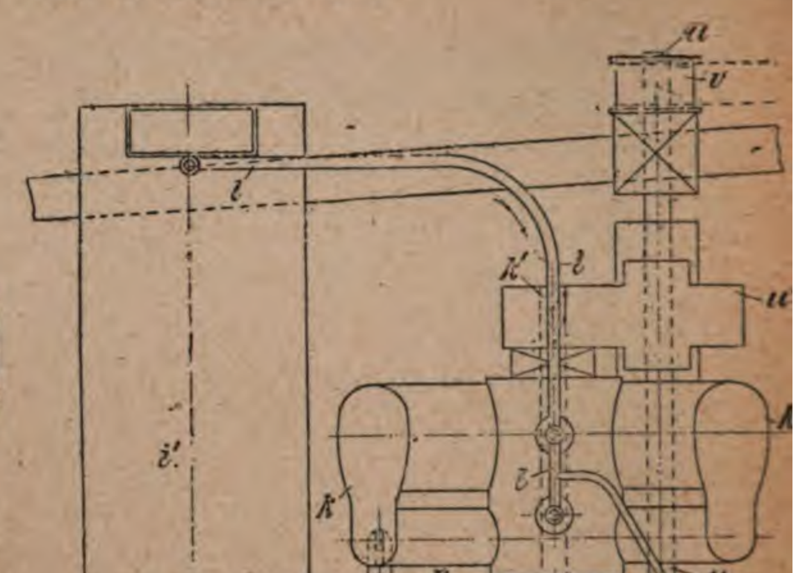


FIG. 3.—Plan of Motor Apparatus.

The water container and heating surface, which consists of a spiral coil, is disposed directly on the end of the burner, and the gases of combustion made to pass within an inner coil, or on both sides of this coil and an outer one, and then on the outside of an outer coil.

Water is fed to the coils, in regulated quantities, by a pump continuously, and governed in the manner stated.

The whole apparatus, namely, vaporizer, burner and steam generator, is arranged horizontally, and is of cylindrical form, the water-containing parts being near the end of the burner, and the heating surface or generating portion being contained in a light casing; the whole being arranged under the floor of the vehicle.

In the drawings, Fig. 1 is a longitudinal section showing a burner attached to a steam generator of the type referred to; Fig. 2 is a cross-section through the burner, half taken at the line A, A and half at the line B, B. This apparatus comprises a chamber in which the oil is vaporized, a part in which the air used to support combustion of the gases of the oil is heated; and a burner portion proper.

In the drawing (Figs. 1 and 2) the oil vaporizing chamber is designated a, and is formed by an outer circular wall, a^1, an inner annular wall, a^2, an end wall, a^3, and an end cover, a^4, bolted on the ends of the wall a^1, a^2. The chamber is thus annular. The air heating chamber is designated b, and is of similar form to a; its outer and inner walls, b^1, b^2, being continuations of a^1 and a^2 respectively, while the outer wall b^1 closes one end, and the other end being closed—except at the upper part, where it communicates with a—by the wall a^3. This wall a^3 constitutes a partition between the chambers a and b. The communication between the chambers b and a is at the highest part and is made by a portion of this wall being cut away. The entrance of air to the chamber b is by the branch b^4 at the bottom of this chamber, this branch being connected with the source of supply of air. Within the chamber b there are thin annular ribs, b^5, which convey heat from the burner within the wall b^2 to the air as it passes through the chamber b. The oil (ordinary petroleum) is introduced into the chamber through the pipes c, enters through the top of the outer wall a^1, and falls on to the upper part of the wall a^2, at either side of the center. Within the chamber a there are a series of partial partitions, a^5, extending out from the walls a^2 and a^4 alternately, and also extending radially from the inner wall a^2 to the outer wall a^1. These partitions cause the oil vapor and air to flow in a circuitous course through the chamber a.

Within the wall a^2, at the front end of the burner, is a chamber, d, closed at one end by a bolted-on cover, d^1, and having a perforated wall, d^2, at the other end. The perforations in this wall are numerous, and are in the form of tubular passages of small diameter, arranged closely together, and relatively long. This proportion is conveniently provided by making this wall, d^2, of thick metal, and drilling or coring out the holes through it. In the front end of this wall there is inserted a gauze diaphragm, d^3, for the purpose of insuring that no back firing shall take place; a second wire gauze diaphragm, d^4, may also be provided.

In front of the wall d^2 there is a perforated block, e, some fire-resisting material, for breaking up the flame jet and obstructing its flow, thereby reducing its velocity and increasing its heating action in the steam generator. It also assists in lessening noise in the combustion.

The chamber a communicates with the chamber d by an opening at d^5, in the bottom of the wall a^2. Communication between the outside of the burner and the space in front of the wall d^2 is by means of a tube, f, which passes through a cover, d^1, and the wall d^2, and is provided with a cap, f^1. By removing this cap and introducing a kindling device the combustible fluid issuing through the wall d^2 is ignited.

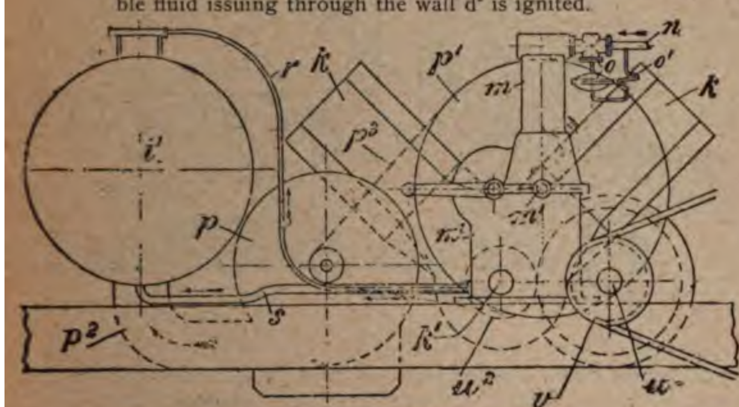


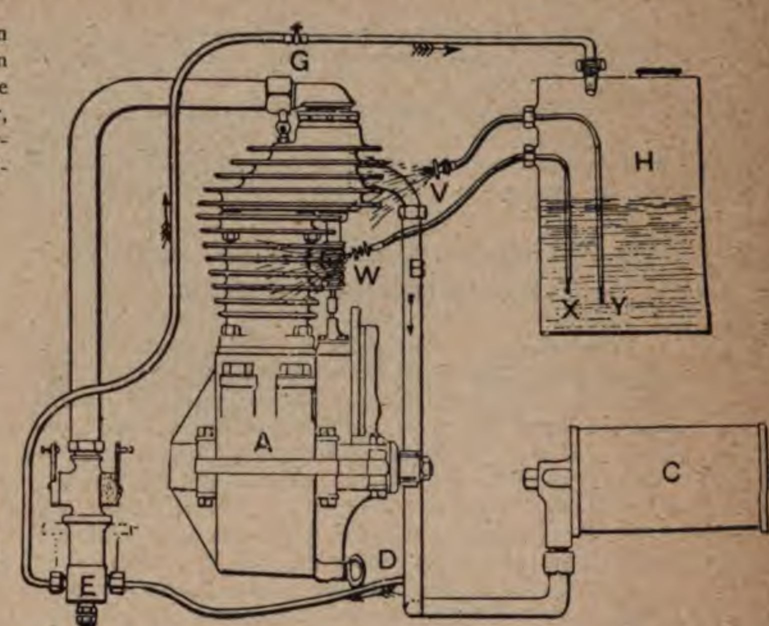
FIG. 4.—Elevation of Motor Apparatus.

In the drawings h represents the water tubes of the steam generator to be heated by the burner, three coils being shown. Outside these coils h, and also the chambers a and b, there is a casing, i, of a non-conducting material, such as asbestos, held between two sheet plates. At the bottom, beneath the chamber a, is a removable cover, j, while at the upper part over the chamber b is a cover, j^1. When the apparatus is cold and it is required to start it these covers are removed and the heat of a lamp is conducted through the space of an opening in i—which is normally covered by j; and this heat passes round the outside of the chambers a and b and out by j^1, thereby heating both the air and oil vaporizing chambers.

At starting, or when the apparatus is cool, the oil supplied to the chamber a and falling on to the plate a^2 flows on both sides over this plate and is vaporized, and passes with the air to the chamber d; while when the apparatus is in full heat and work the hot air coming from the chamber b (where it receives its heat from the wall b^2 and annular webs b^4) vaporizes the oil; and this same air also serves to support the combustion of the oil vapors it carries, being together a combustible or inflammable mixture. This heated air and oil vapor therefore pass together in zigzag fashion through a and become intimately mixed; and pass up through the lower aperture d^5 in a^3, into the chamber d, and thence through the holes a^3 in the diaphragm. And this combustible mixture of air or oil vapor or gas burns, at the discharge ends of these apertures, being first ignited by passing a kindling device through the tube f; and they burn at the end of these holes as nozzles in the space between a^3 and e. The device e acts as an obstruction and breaks up the flame and its velocity, the effect of which is that a steady and more effective burning and heating action of the combustible gases is afforded, while it also, with the other parts, tends to obviate roaring, hissing or noise.—The Automotor.

Cooling Cylinders by Spray of Water.

The Société Bourguignanne d'Automobile, Dijon, France, is employing a novel device for cooling the cylinders of the Gaillardet motors employed on its voiturettes, says Le Locomotion Automobile. It consists of a patented method of spraying the cylinders with water. The arrangement is very simple. The exhaust passing from the motor through the pipe B enters the muffler C. From the pipe B a smaller pipe, D, extends to the carbureter and thence up over the top of the motor and debouches into a reservoir, H. A valve, G, permits the supply to be shut off from the reservoir and allowed to escape into the open air. In this manner a pressure is caused in the reservoir, forcing the water out by the tubes X and Y through the nozzles V and W in the form of a fine spray. This mixture of air and water produces a circulation of moist air around the motor when the carriage is in motion, the effect of which is said to be seen in the improved working of the motor.

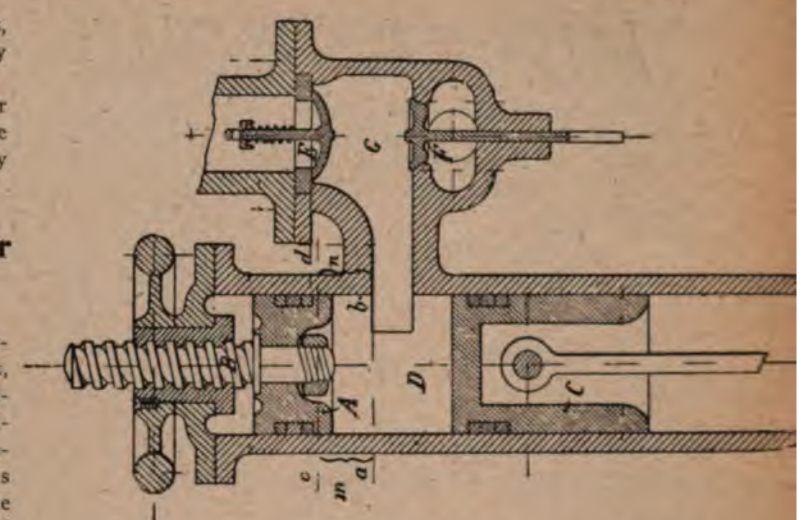


NEW MODEL GROUT GASOLINE CARRIAGE.

At the ends of the tubes in the reservoir are two small filters, to prevent any foreign substance from stopping up the spray nozzles.

The consumption of water is said to be only two liters for 180 miles, and the vehicle is relieved of the weight of the pump, radiator, reservoir and other paraphernalia generally used for cooling.

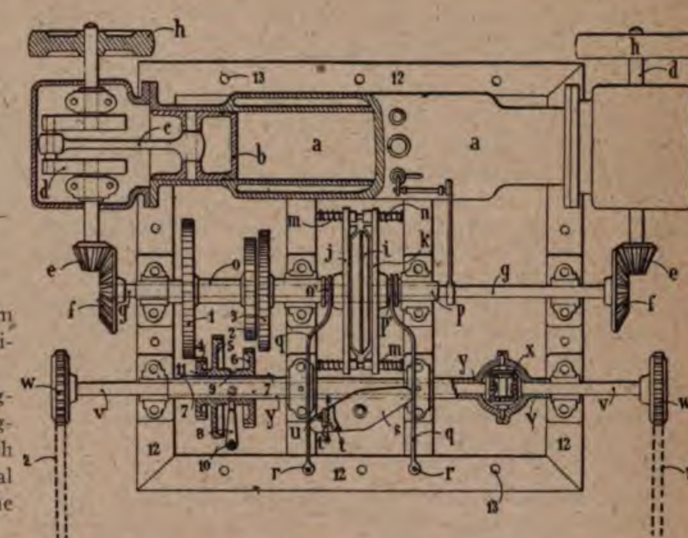
The Malezieux Compression Regulator for Petroleum Motors.



The accompanying illustration gives a section of an arrangement which has lately been devised by M. F. Malézieux, a French engineer, for regulating the compression of the explosive mixture in petroleum spirit motors between the maximum and minimum degrees permitted by the motor. Referring to the illustration, A is the regulating piston, which is controlled by the hand wheel and screw B, C is the piston of the motor, D the explosion chamber, E the admission valve and F the exhaust valve. As regards the method of operation of the regulator, if a b represents the position of the piston A for maximum and c d for minimum compression, it will readily be seen that any desired degree of compression between the two may be obtained by means of the regulator, the compression of the carbureted gas varying inversely with the space in which it is contained. Thus, by increasing the capacity of the explosion chamber by means of the movable piston the effect of the explosion is reduced and the motor slowed down. In a petroleum motor carriage the regulator can be arranged to be controlled from the drivers' seat, so that not only can he increase or diminish the power of the motor while running, according to the character of the route being traversed, but when it is necessary to stop the position of the compression piston can be readily so regulated as to reduce the speed of the motor to the minimum.—Motor Car Journal.

DE DIETRICH POSTAL WAGON FOR THE FRENCH SOUDAN.

MOTOR VEHICLE PATENTS
of the world



UNITED STATES PATENTS.

No. 635,231—Resilient Hub for Vehicle Wheels.—William Edward Carmont, Kingston-upon-Thames, England. Application filed Feb. 6, 1899.

In each of the two faces of a hub are formed proper segmental wings at parts thereof, which are intersected by segmental wings of end plates and form annular channels in which rubber rings can be located, the spaces between the several wings and of the ends thereof allowing for expansion of the rubber as the resilient body on which the load is supported.

By this invention, it is claimed, the compression of the rubber, due to the load, becomes distributed over the entire area of the rings G G, both above and below the axial vertical line, and as the wheel travels this compression is ever variable, so that the parts of the rubber not under compression are free to expand and so maintain the resiliency of the same and prevent any part becoming rigid, such as when the rubber is so confined or wholly boxed in.

Prior to this a resilient pneumatic hub for a wheel was known in which the compression took place practically over the entire half of each one of two complete concentric rings which were employed on the hub and outer part of the wheel. In this invention the "concentric rings," as they are termed, are formed in segments, neither one being complete until the hub A and face plates F are brought together, whereby the compression of the rubber, instead of being exerted over one entire half of either ring, is distributed proportionally to different parts.

No. 635,171—Driving Gear for Motor Vehicles.—Louis Mathieu, Paris, France. Application filed June 30, 1899.

This driving gear comprises a motor having a single cylinder, a, with two pistons, b, acting in opposite directions relatively to each other. These pistons jointly transmit by connecting rods, c, rotation to two crank shafts, d, and therefrom by means of gearing, e and f, to a distributing shaft, g, which revolves not so fast as the crank shafts d. These parts are all arranged symmetrically relative to the axle of the vehicle. The two crank shafts d carry fly wheels, h.

At or about the center of the distributing shaft g is keyed a disk, i, having a double beveled edge, and upon each side of this disk plates, j k, are arranged, having their inner faces hollow and shaped to conform to the said disk i. These hollow-faced plates j and k are free to slide on the distributing shaft. They are guided by studs, m, and are acted on by springs, n, which tend to press them against the disk i. These plates j and k are keyed upon sleeves, o p, adapted to slide and turn freely upon the shaft g, their movement along the shaft, although very slight, being obtained by means of two forks, q, pivotally connceted to the vehicle at r and engaging with grooves o' p', provided in the said sleeves. These forks can be actuated by a cam, s, carrying a toothed sector, t, which gears with a similar sector, t', fixed to a vertical lever, u, mounted on a suitable part of the vehicle, or by any other equivalent arrangement. The disk i, which is keyed to the shaft g, and the plate j, which is secured to the sleeve o, enable the sleeve o to be connected with and rotated by the shaft g, thereby rotating the wheels 1, 2 and 3. The plate k merely serves to balance the clutch part of the driving gear or maintain the latter symmetrical in motion.

The intermediate shaft v has a differential gear, x, inclosed in a box, y. This box is provided with a sleeve which covers the shaft v on its length. This shaft v carries at its ends spur wheels, w, which by means of chains, z, set in motion the wheels of the vehicle.

The gearing between the driving shaft g and the intermediate shaft v is arranged to provide three speeds. The sleeve o carries a set of gear wheels, 1 2 3 (say three of different diameters), which may gear when desired, respectively, with the whees 4 5 6 of another set keyed on a sleeve, 11, slidably adjusted upon the sleeve y, which is free to turn on the shaft v, arranged parallel to the distributing shaft. If preferred, these wheels 4 5 6 may be made in one part with this sleeve 11. This sleeve 11 is connected to the sleeve y by the linch pin 7. A fork, 8, engaging a groove, 9, and pivoted at 10 to the vehicle, allows of the sliding movement of the sleeve 11 and of the wheels 4 5 6 connected therewith.

No. 634,979—Electric Motor for Driving Motor Carriages, Etc.—Henry William Headland, London, England. Application filed Jan. 18, 1898.

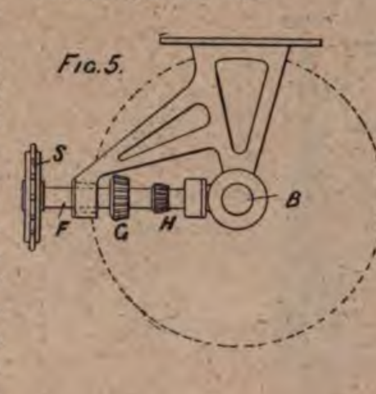


Fig. 5.

Fig. 6.

This electric motor belongs to the class having the armature fixed on the shaft, and the field magnets applied to a casing or frame rotating freely on the shaft in the opposite direction and having bevel tooth wheel gearing arranged between the said shaft and casing. The construction of the bevel tooth wheel gearing is such that the end strains caused by the bevel wheels are confined within the same strucutre or frame, and also such that the power may from the same motor be taken off in various directions at various angles and at different speeds, as desired, whereby it is claimed to adapt itself as a stationary or portable motor to various useful purposes.

No. 635,218—Oil Valve for Gasoline Engines.—Alexander Winton, Cleveland, O. Application filed June 7, 1899.

S is an oil reservoir supported in any suitable manner and with the lower end of which a pipe, T, communicates, and this pipe also communicates with a pipe, U, at right angles thereto, and passing through this pipe U is a cut-off-valve stem, V. At the inner end of this pipe T a nipple, d, is rotatably attached, the opposite end of the nipple being externally screw-threaded and passing through an internally screw-threaded shoulder, e, formed upon the pipe Q. This nipple is provided at its inner end with an elongated valve-stem opening, f. The inner end of this opening is formed into a valve seat, g, and receives the valve upon the outer end of the valve stem P. The inner end of the nipple furnishes a support and a guide for the outer end of the valve and valve stem, as the opening s in the nipple is made sufficiently small to always insure the point of the needle valve registering with its converging tapering wall when moved into a close position.

It is desirable to provide at all times a tight fitting of the oil valve when it is seated, and to accomplish this the nipple is longitudinally adjustable by screwing it through the enlargement e upon the tube Q and clamping it in its adjusted position by means of a clamping nut, i.

In adjusting the nipple, and thereby regulating the seating of the oil valve, the nipple is turned until it is noted that the pin b, which unites the opposite end of the valve stem P to the inlet port valve stem G, has a slight inward or backward movement, and then the nipple is tightened by the lock nut i. In this way any wear of the valve and the valve seat is readily taken up, and it also enables me to provide a perfect seating of the valve, which will not necessitate the turning up of the cut-off valve V when the engine is not running. The nipple is provided intermediate its ends with a projection, m, adapted to receive a wrench for adjusting it. By means of this adjustment the seating of the oil valve and of the inlet port valve can be made to occur at the same time, and yet a tight fit of the oil valve accomplished to prevent any leaking of the oil when the engine is not in operation.

The inwardly extending tubular cap F and the outwardly disposed cup-shaped piston I furnish a dash pot for preventing the hammering of the inlet port valve and also of the oil valve, which prevents not only injury and wear to the valves and the valve seats, but also prevents disagreeable noise.

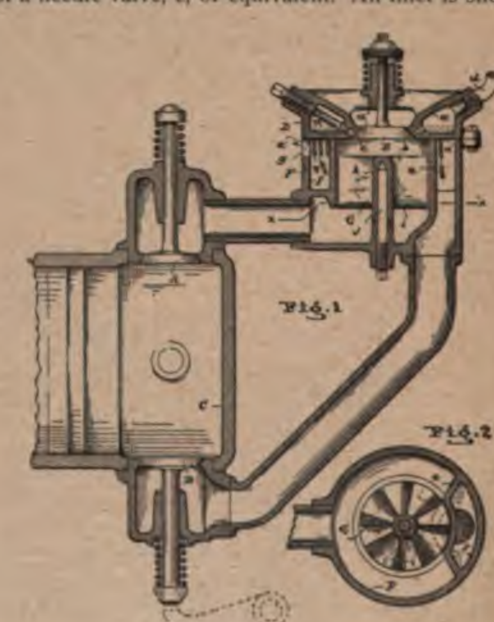
In operation, when the inlet port valve D is moved inward from its seat for admitting the explosive material the needle valve is likewise removed from its seat, permitting a flow of liquid to the pipe Q, and this is conveyed through the said pipe to the explosive inlet port through the opposite end R of the pipe Q. This arrangement insures a positive feed of the liquid to the pipe Q at each inward movement of the inlet port valve, since the needle valve is connected to the stem thereof, as before described. When it is desired to absolutely cut off the flow of the liquid (as when the engine is out of operation), the valve D is screwed to its seat.

No. 635,166—Vaporizer for Gas Engines.—Walter Hay, of Seville, O., assignor of one-half to Emerson M. Hotchkiss, Waterbury, Conn. Application filed May 21, 1898.

The apparatus combines a vaporizer, a mixing valve, an agitator, and an "exhaust muffler."

The vaporizer D consists of an annular receptacle, a, concentric to which is arranged the mixing valve E.

The receptacle a proper is of hollow ring form, with a flat base, a', and an angular inner face, a'', which serves as a seat for the valve E. A series of outlets, b, from said receptacle terminate in said seat, and one or more of them are under control of a needle valve, c, or equivalent. An inlet is shown at d.



Adjoining the base a' is a double shell casing, F, within the inner part (shell e) of which is placed the fan wheel G, while the upper outer compartment F serves as a means for heating the inner compartment and the receptacle above referred to, the exhaust gases being conveyed through said outer compartment. The inner and lower compartment connects with the inlet valve chamber by means of a pipe or equivalent, and a like connection is established with the upper and outer com-

partment and the exhaust valve casing. For escape of the exhaust provision is made by way of the openings g.

In emitting the exhaust gases from the cylinder into the compartment f ebullition is effected of the liquid contained in the receptacle a. The vapors, however, rising from the liquid fuel remain confined within the receptacle when and while the valve closes the seat a″.

With this apparatus it is presupposed, and provisions are so made, that the main inlet valve A, as well as the valve 7, will open only during an actual suction stroke of the piston.

The wheel G constitutes a hub, h, and a series of slanting blades, i, the hub being suspended from a pivot or pointed post. The suction action of the piston induces a rapid current, which tends to reach the cylinder in the straightest possible course.

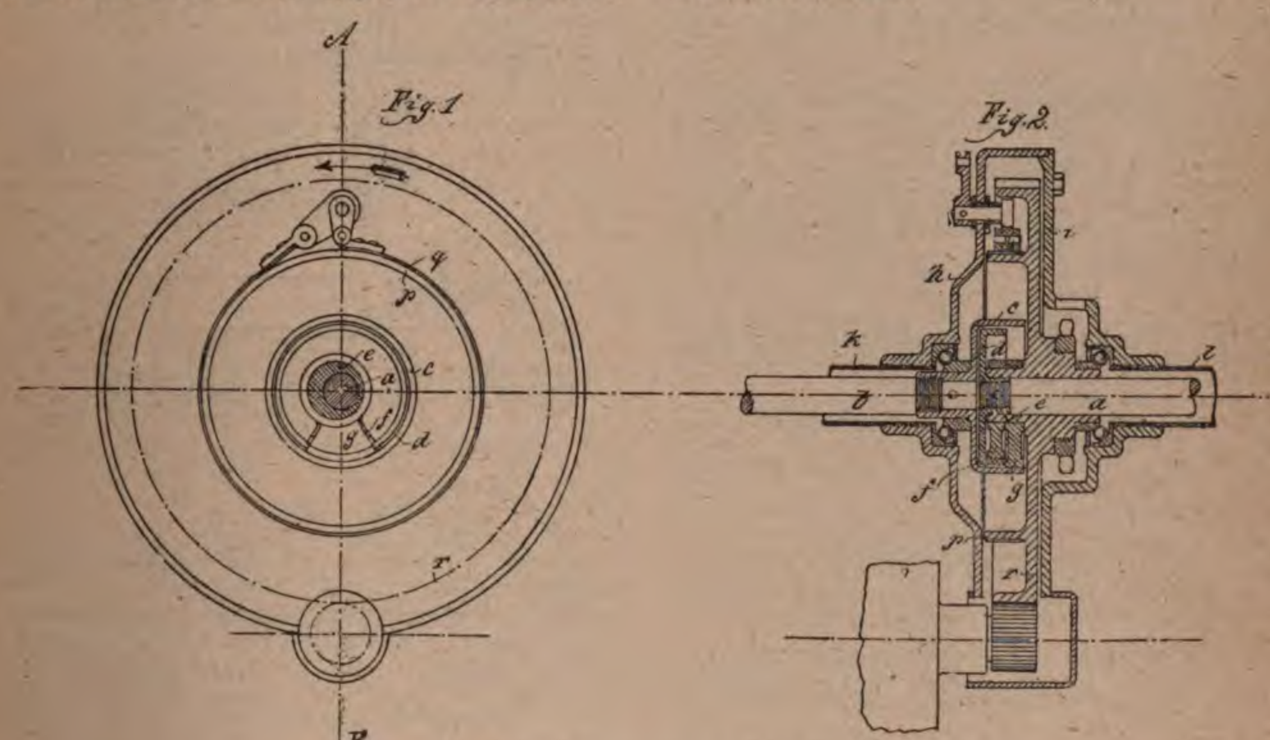
BRITISH PATENTS.

No. 14,344—Improvements in or Relating to Driving Gear for Motor Vehicles and for Other Purposes.—Friedrich Moritz Hille, Dresden, Germany. Application filed July 12, 1899.

with other systems, that it works without noise and shock and that the operation of coupling does not depend on certain relative positions of the parts to be coupled, the coupling being possible at any time and in any position of the parts. Besides these advantages the friction cups act as a protective case against dust and damp, while the absence of teeth, pawls, bolts, springs and the like, which are easily injured, is a decided advantage.

In the accompanying drawing a method of construction suitable for tricycles and other similar vehicles is illustrated by way of example, Fig. 1 being a view of the casing h with the side plate i removed and the driving gear with a section through the eccentric sleeve e of the driving wheel, while Fig. 2 is a transverse section on the line A B of Fig. 1.

The axle halves a and b, each of which is provided with its corresponding road wheel, are supported on ball bearings in the sleeves k and l (Fig. 2), which are connected with the casing h and side plate i respectively. The road wheels are not shown in the drawing. The two cup disks c and d, with a free space between them, secured to the ends of the two abutting axle halves, can be made to gear with each other and act as friction disks.

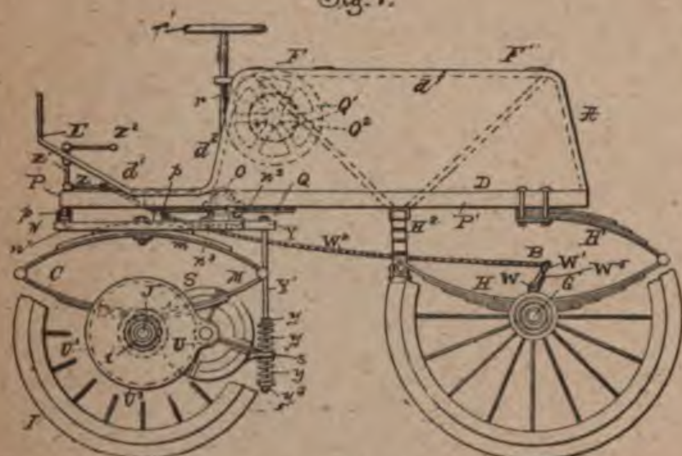


DRIVING GEAR OF FRIEDRICH MORITZ HILLE.

On the eccentric hub of the driving (toothed) wheel revolubly arranged about the divided axle are two friction disks revolubly arranged side by side, which can engage with the inner sides of two hollow cylindrical friction disks or cups provided respectively on the two parts of the divided axle in order to couple both wheels when the carriage travels in a straight line, owing to the wedging effect of the eccentrics and uncoupling the friction disk of the outer wheel when the vehicle travels on a curve, thus setting the outer wheel free to partake of the necessary greater angular velocity. This system of eccentrically arranged friction disks in combination with friction cups is characterized by the fact, as compared

The wheel r, driven by the motor o', is revolubly arranged on, say, the right half a of the axle and is provided with an eccentric sleeve e (Fig. 1) projecting into the hollow space of the friction cups c and d. On this eccentric sleeve are revolubly arranged side by side and independently of each other two friction disks g and f, the disk f co-operating with the cup d on the axle half a, while the disk g co-operates with the cup c on the axle half b. The friction disks are pressed against each of the friction cups when the driving wheel r revolves in the direction indicated by the arrow and the vehicle moves in a straight line, thus coupling the driving wheel r with both halves of the axle. When, however—in describing curves—

Fig. 1.



one of the road wheels increases its angular velocity, the coupling produced by friction between the disk g and its corresponding cup, c, is broken, thus allowing the outer wheel, describing the greater curve, to run freely and to increase its angular velocity without hindrance, the inner wheel running on the shorter curve acting alone during such time as the driving wheel.

For braking purposes a concentric brake disk, p, provided with a brake band may be cast in one piece with the driving wheel r. This brake device, however, forms no part of the present invention.

No. 7,605—Improvements in and Relating to Automobiles.—Samuel Yoke Heebner, Philadelphia, Pa. Date of application, April 11, 1899.

Claims.—In a vehicle, the combination of the body, the rear running gear, the body frame connected thereto, the front running gear, a supplemental frame therefor, the electric motor mounted upon the front running gear, and turning bodily therewith, whereby it is adapted to apply power at all times on lines parallel to the path of said gear, and means for connecting the said front running gear frame with the body frame on a verticle axis in rear of the front axle.

In a vehicle, the combination of the springs extending upward from the axle, the frame connected to said springs, the electric motor suspended and supported partly from said axle and partly from said frame, means for connecting the said frame to the body frame on a vertical axis behind the front axle, and a pivoted ring concentric with said vertical axis and means engaging with said ring for positively moving the front axle bodily around the said vertical axis.

No. 562—Improvements in Motor Tricycles and Motor Vehicles Driven by Petroleum Spirit Engines.—Dawson Fyers Duckworth Turner, Edinburgh, Scotland. Applied for Jan. 10, 1899.

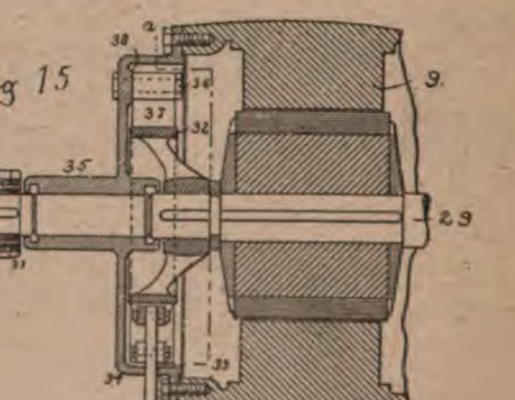
This invention relates to a method of heating the petroleum spirit in cold weather or after a long run (when the lighter spirit has fractionated off) so as to obviate the difficulty of

starting the engine. A tube is carried through the spirit reservoir or carbureter through which warm water may be passed and if necessary retained there until the spirit has been raised to a sufficient temperature to freely give off vapor. This tube may form part of the branch exhaust tube found in some moto-tricycles.

No. 13,338—Improvements Especially Relating to Motor Road Vehicles and to Braking Apparatus for Use in Connection Therewith.—Albert Laurintin Larson, Chicago, Ill. Application filed June 27, 1899.

This invention contemplates a number of improvements in the construction of the perch intervening between the front and rear wheels, the suspension of the motor or motors from the perch, the provision of improved steering apparatus whereby the front or steering wheels mounted upon individual shafts may be inclined at suitable angles with the roadway without binding the parallel bar or lever mechanism uniting stems projecting from the angulalrly extending knuckle hubs of the individual shafts, and the provision of improved bearings upon which the knuckle hubs may be supported. The invention also contemplates the provision of improved braking apparatus of simple construction, and by which the brake may be readily applied and maintained in any adjusted position.

Fig 15



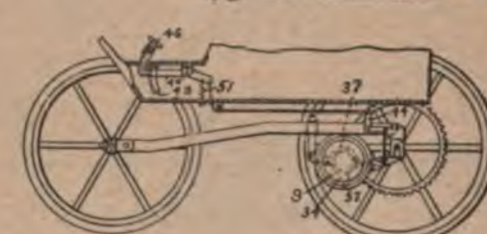


Fig-16

Fig 17

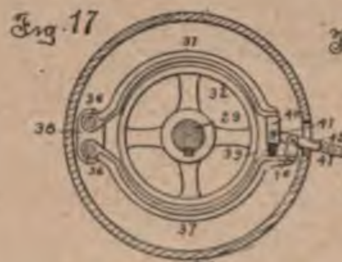
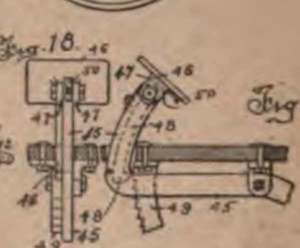


Fig-18.

Fig-19



Claim.—The combination with a rotatable element, 32, of brake shoes 37 37, each pivotally mounted at one end, the said brake shoes inclosing the said rotatable element, centripetally acting spring mechanism for normally maintaining a disengagement between the said shoes and the said rotatable element, a link 42 having connection with each opposed free end of the brake shoes, the connections of the said opposed ends with the link being separated, whereby upon proper actuation of the link the free ends of the brake shoes are caused to approach to engage the rotatable element, the said link having an elongation, a cap 34 for inclosing the brake shoes, a slot in the said cap through which the said elongation passes, and actuating means for operating the said link to cause the operation of the brake.

No. 6,125—Improvements in Electrically Operated Motor Road Vehicles.—Pope Mfg. Co., Hartford, Conn. Application filed March 21, 1899.

This is an attempted simplification of the methods of controlling electric vehicles.

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

WANTED.

Special contributors to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.

FOR SALE.

A "Locomobile," direct from the factory, with makers' latest improvements, and tools, bell, etc., besides. Price, $800.00. Can be seen in New York. Immediate delivery. Address K. B.,
Care HORSELESS AGE.

PARTS.

Front axle complete for four foot track with complete steering device with rods and handle. Reaches all ironed with brass boxes attached for either roller or plain bearings. Rear axle with or without differential, braces, collars, etc. Gearing, etc. Write for prices and drawings.
A. L. DYKE, Hope, Ark.

We are delivering motor vehicles regularly. Four styles. Catalog free. Motors and supplies on hand. Also two second-hand machines at attractive prices.
DURYEA MFG. CO.,
Peoria, Ill.

LOCOMOBILE WANTED.

$700.00 offered for new Stanley Locomobile, delivery before October 15th. LOUIS WILCOX, Grand Avenue, Corner Atwater Street, New Haven, Conn.

WANTED.—*Vol. 1, No. 1, Vol. 2, Nos. 5, 6, 7, 8, 9, 10, and Vol. 3, No. 1.* A new number of the weekly will be given in exchange for any one of these, *if in good condition,* and for Vol. 1, No. 1, four numbers will be given if in good condition. HORSELESS AGE, American Tract Society Building, Nassau and Spruce Streets, New York.

DRY BATTERIES
For Sparking Gas and Gasoline Motors.
LONG LIFE, RELIABILITY, HIGH VOLTAGE.
IN SUCCESSFUL USE FOR THIS PURPOSE.
Dow Portable Electric Assistant Co., 218 TREMONT ST., BOSTON, MASS.

Graphite Lubricants,
ALL KINDS, ACCORDING TO WANTS.
Special preparations for Gears of Electric Motors and for Cylinders of Motor Engines. **Send for Circulars and Prices.**
Joseph Dixon Crucible Co., - Jersey City, N. J.

LEONARD HUNTRESS DYER,
Specialty: Patents and Patent Causes,
908 G Street, N. W.
Cable Address: "Dyerpatent, Washington." **WASHINGTON.**

BALDWIN DETACHABLE CHAINS
made for Automobiles, in sizes to suit all requirements. Prompt deliveries made. Address:
BALDWIN CYCLE CHAIN CO.,
WORCESTER, MASS., U. S. A.

AUTOMOBILE CHARGING AND REPAIR STATION
We Make, Rent, Recharge and Repair
STORAGE BATTERIES.
THE STORAGE BATTERY SUPPLY CO.
Established 1891. Telephone, 1065 Madison Square. Incorporated 1898.
OFFICE AND WORKS: 239 East 27th St., New York City.

Seamless Cold Drawn Steel Tubing, Shells, Cylinders and Tanks, For Air, Gas, Steam, Ammonia or fluids under pressure and explosives. ☞ Seamless Steel Tested Tanks of Sundry Diameters.
DROP FORGINGS AND STEEL STAMPINGS.
JANNEY, STEINMETZ & CO., Drexel Building, Philadelphia, Pa.

VOLUME FOUR COMPLETE.
(April 5th to September 27th, 1899, inclusive.)

To New Subscribers for Two Years.

We wish to place these volumes in the hands of persons permanently interested and therefore offer them only to those who will subscribe for two years from April 5th, 1899. :: :: ::

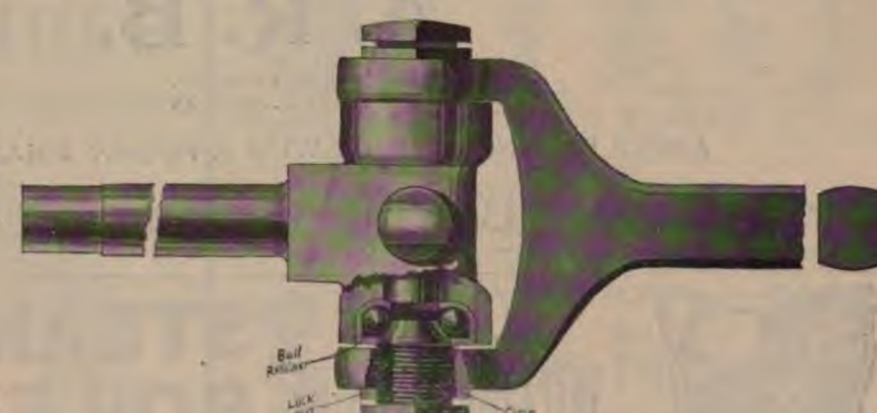
SEND $4 AND GET THIS VOLUME BEFORE IT IS EXHAUSTED.

MOTOR WHEELS.

STEERING DEVICE

WITH

BALL BEARINGS.



RIMS. CRESCENT SHAPE AND FLAT BASE

FLARING EDGES IF DESIRED.

WESTON-MOTT CO., UTICA, N. Y.

IN BUYING A MOTOR CARRIAGE.

Honest, common-sense, logical argument should be considered.

Fancy talk unsupported by fact counts for naught when directed at a sensible, reasoning mind.

An "all season" motor carriage that will go anywhere under all ordinary conditions is alone to be considered. Such a product is ours, and your order placed now means almost immediate delivery.

The Winton Motor Carriage is years beyond the age of experiment. It is a demonstrated, practical success—not a "factory" success, but a satisfactorily operated carriage in the hands of our many pleased customers.

THE WINTON MOTOR CARRIAGE.

It can be relied upon at all times.

WRITE FOR CATALOG.

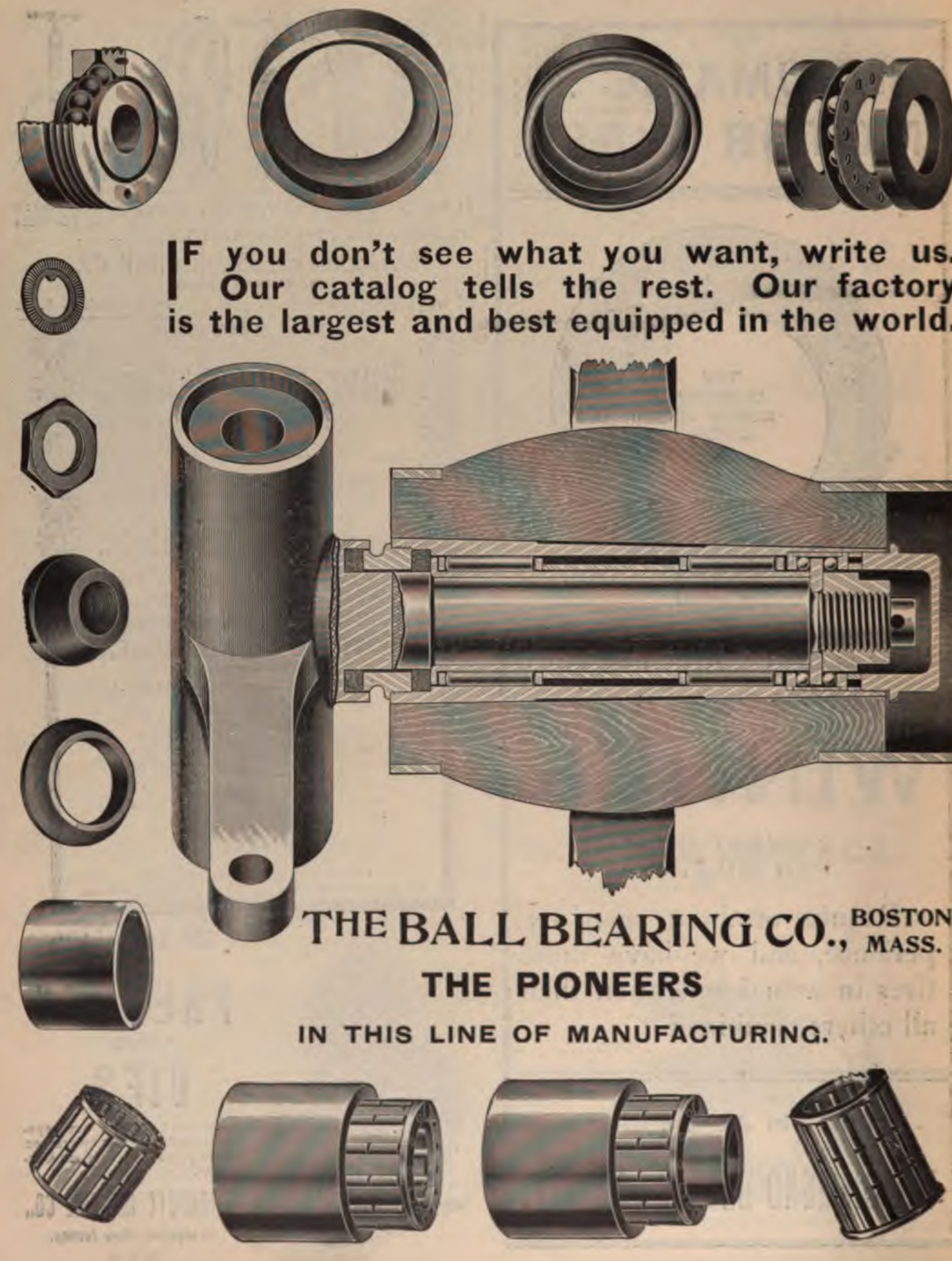
ABSOLUTE SAFETY.
FREEDOM FROM NOISE.
ABSENCE OF ODOR.
SIMPLICITY.
EASE OF HANDLING.
DURABILITY.
PERFECT CONTROL.
ECONOMY OF OPERATION.
NO WASTED POWER.
ELEGANCE OF DESIGN.
HANDSOME FINISH.
RECORD FOR SPEED.

PRICE, $1,000. NO AGENTS.

Running 707.4 miles on rough roads, between Cleveland and New York, in 47 hours and 34 minutes, and completing the trip with carriage in first-class condition—every working part in perfect order—is the best possible argument for strength, speed and durability.

IF YOU ORDER NOW NO AGGRAVATING DELAY IN SECURING DELIVERY WILL FOLLOW.
IF YOU HOLD THE ORDER UNTIL SPRING THE DELAY WILL SURELY FOLLOW. :: :: ::

THE WINTON MOTOR CARRIAGE CO., CLEVELAND, OHIO, U. S. A.


IF you don't see what you want, write us. Our catalog tells the rest. Our factory is the largest and best equipped in the world.
THE BALL BEARING CO., BOSTON, MASS.
THE PIONEERS
IN THIS LINE OF MANUFACTURING.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS

VOL. V. NEW YORK, NOVEMBER 1, 1899. No. 5.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

Power Storage Fallacies.

Will this power storage fallacy never down? Its latest appearance is chronicled in the New York Times of recent date under the confusing title, "Storage Battery Development." This singular example of mixed mechanics and bad arithmetic reads as follows:

The Storage Power Company, of which Henry L. Sprague, of the law firm of Stetson, Jennings & Russell, is to be president, will have the following directors: Dr. William Seward Webb, president of the Wagner Palace Car Co.; William L. Bull, ex-president of the New York Stock Exchange; Andrew G. Blair, of Ottawa, Canada, Minister of Railways of Canada; Frederic Nicholls, of Chicago, president of the Woods Motor Vehicle Co. and president of the Canadian General Electric Co.; Nathan A. Guilford, general traffic manager of the New York Central Railroad; Frederick B. Jennings, vice-president of the Bennington & Rutland Railroad; Alfred G. Ames, of Toronto, vice-president of the Toronto Trust Co.; Henry L. Sprague, of Stetson, Jennings & Russell; J. Wesley Allison, United States representative of Canadian railways; Edward Barr, ex-treasurer of the Brooklyn Bridge, and William E. Prall.

In the prospectus of the company, just issued, the principles underlying the systems of generating and utilizing superheated water and compressed air for motive power are explained, and the statement is made that superheated water is undoubtedly the greatest storage power medium that has ever been discovered. The prospectus says:

The enormous loss of initial condensation which takes place in the engine when using steam is largely saved when superheated water is vaporized in the engine. The engine for using superheated water is different in its construction from that of the ordinary steam engine. The high pressure and temperature of superheated water require naturally a different valve mechanism from that of steam.

The engine that we now have in operation on the New York Central Railroad is a double tandem cross compound, which would be the character of engines best adapted for railway and heavy truck purposes. The apparatus for generating superheated water is very simple indeed, and may be very cheaply established in any ordinary mercantile establishment where trucks and delivery wagons would be employed.

It consists of a number of upright steel tubes joined together at the top and bottom in a manner to permit of perfect freedom of expansion and contraction, perfect impingment of the heat, and perfect natural circulation of the water. The tanks carried on the vehicle or car are protected from radiation by a peculiar covering. These tanks may be filled in one or two minutes' time by simply making connection with the pipe leading to the generator.

From a single 1,000 lbs. of this water the inventor has been able to utilize 350,000 available heat units. By this simple system an almost costless power when compared with electric storage is obtained.

Compressed air and superheated water may be employed by this company under its patents, if it shall be found desirable, for light character of work, such as automobiles. For the light work, such as delivery wagons, 30 lbs. of storage water, which can be taken into the tank in about one minute, would be sufficient to make a trip of 25 miles; in cases where longer trips would be necessary, the amount of water would be increased.

Superheated water, although heretofore but little known to the engineering fraternity, has been subjected practically to the several tests. A heavy railway car has already been running on the New York Central Railroad at a speed of over 25 miles an hour, with such satisfactory results that the company is now producing for that road a new apparatus, which will produce much greater power and speed.

The advantages of such an automobile car for truck-line work, as well as for general suburban tramway work, is acknowledged by all railway men.

It is stated that a new car under construction for the company will be built in about 60 days and soon thereafter it is expected that the first practical auto-truck ever seen in the streets of New York will be exhibited.

Superheated steam or the "hot water" system of power storage, as it is sometimes called, is not new to the engineering fraternity. It has been thoroughly investigated and discarded by all the ablest inventors and engineers who have undertaken the solution of the motor vehicle problem. Weight, limited radius, complication and cost have condemned this for general use, as they have all other power storage systems for vehicles. That water is the greatest absorber and retainer of heat is generally admitted, but the moment we undertake to store it and utilize it in vehicles we necessarily waste a large proportion of this stored energy. High pressures cannot be controlled without heavy tanks and special valves difficult to maintain; heat cannot be stored in the open air without great loss by radiation; all power storage systems involve more or less expensive apparatus for the making and storing of the power, and when the weight and complication of the tanks and controlling mechanism and the weight of the vehicle required to support this plant are considered, the total cost of operation is found to be prohibitive as compared with the several direct power systems already tried and proved in the field of locomotion. It is impossible to store power without excessive weight, as has already been said in these columns. The figures above given are based on inventors' arithmetic. The statements that an almost costless power may be obtained by this or any other storage system and that 350,000 available heat units can be utilized from 1,000 lbs. of hot water in practice are most emphatically denied.

Compressed air, too, may be employed for light work in connection with hot water, we are informed, although the work of hauling the overgrown power plant alone would be anything but light, and some other power storage system would probably have to be called in to help out.

If complication and expense are the goal for which the promoters of this system are aiming, we would suggest that they add a storage battery and a liquid air motor to their power outfit, and the reductio absurdum will be complete. If, however, they really cherish any hopes of doing business in this field, they would best get acquainted with the good old-fashioned steam and gasoline engines at once.

Steam Vehicle Licenses.

The long-anticipated subject of licenses for steam vehicle operators is now coming up for settlement. In New York, Washington and other cities the authorities have already taken the position that the boilers of steam vehicles are subject to the same regulations as marine and stationary boilers, and must therefore be in charge of licensed engineers. In several cases where information has been sought by users, however, it has been intimated that the examination as regards operators of light carriages would not be as rigid as that required when boilers of larger horse-power were concerned, but that the inspectors would merely satisfy themselves of the competence of the operator to handle his machine in the public streets.

In some States boilers of small horse-power do not require licensed engineers, an exception which relieves from the law's surveillance a few marine and stationary boilers and carriage boilers of small capacity such as are employed on the light steam carriages now in vogue here.

Manufacturers of steam vehicles in the United States have minimized this matter of inspection and license, which in our estimation will be found to be of no little importance. A steam boiler even of small capacity and automatically regulated will probably be regarded by the law as still a proper subject for its supervision when placed upon a vehicle and carried through the streets. Whether there are extenuating circumstances in favor of the vehicle boiler which would justify an exception is a proper subject for debate. Precedent already established in some parts of the country exempts boilers of small capacity, as has already been said, and a leniency toward the boilers used in our light steam cariaiges has already been shown in some localities. Perhaps this will give us a clue to a reasonable rule for the supervision of vehicle boilers—i. e., one depending chiefly on the horse-power of the boiler and the use to which it is put. The very small boilers are used on pleasure carriages, which generally fall into the hands of an intelligent class capable of mastering them after a little experience. Such persons, upon satisfying the authorities of their ability to operate the machine, might receive a limited license to operate vehicles of this class only. Steam vehicles of larger horse-powers, such as will be needed in merchandise and passenger transportation, should without doubt be in the hands of regularly licensed engineers, like other boilers of the same capacity.

Park Exclusion Rule Contested.

Two enthusiastic members of the Automobile Club of America put their heads in the lion's mouth last week in order to test the legality of the exclusion of motor carriages from Central Park. One of them, the owner of the carriage, was placed under arrest. Should the local magistrate before whom the case is tried sustain the action of the police in making the arrest, the case will be appealed to the Supreme Court and stubbornly contested until a favorable decision is reached. When the charge was made against the alleged offender it transpired that the Board had made no special rule excluding motor carriages, and that the action had been taken solely on the verbal order of the president of the Board. Inasmuch as no rule of the Board now in force specifically mentioned

motor carriages as entitled to admission, the president had assumed that they were excluded by limitation.

All this is the merest trifling, as the Park authorities must now realize. Motor carriages were not in use when the rules quoted were introduced, hence no specific mention of them could have been made unless by a park board composed of prophets, which park boards manifestly are not. Let them not be opposers of progress, however, as in this case they are likely to be. A contest can only result in victory for the automobile. Let the Board be converted by taking a ride in the new conveyance and yield gracefully to the inevitable while there is yet time.

Motor Vehicle Manufacture a New Trade.

The National Carriage Builders' Association, recently in session at Indianapolis, displayed good judgment in voting down the proposition to admit motor vehicle manufacturers to membership. Whoever fathered the idea could not have given it serious thought. Carriage and motor carriage manufacturers have little in common; how little is evident from the fact that even at this late day the average carriage manufacturer's conception of a motor carriage is a horse carriage with a motor fstened to it.

The carriage manufacturer is a woodworker, the motor carriage manufacturera metal worker. The first is an ultra-conservative, unreceptive and antagonistic to any change in vehicle construction; the second must be progressive, open to every improvement and in constant touch with the best commercial and mechanical ideas of the age. In short, one represents the past, the other the future, in locomotion.

It is true the carriage builder is needed in motor vehicle construction, but it is in the capacity of body designer and student of the artistic effect of the ensemble, and not in a mechanical capacity. His traditions will not serve him further in this new field. Here the engineer is supreme, and if the carriage builder is to make any advances in the line of motor vehicle construction it must be as the willing pupil of the master mechanic, by whom the groundwork of the industry must first be laid.

Moving in opposite directions, therefore, and with such divergent purposes and traditions, these two trades cannot possibly be satisfactorily combined.

An association of motor vehicle manufacturers will in time be necessary, but until that time arrives motor vehicle manufacturers will consult their own interests by keeping aloof from all other trade associations.

Option in Wheels and Tires.

The difference in the character of the roads in various sections of the United States calls for a like divergence in the wheels employed. For rough roads larger diameters are preferable, for smooth roads low wheels are the best. Solid tires are regarded by many as more durable than the pneumatic on bad roads, while on good roads the pneumatic is preferred. Between these general limits there is an almost infinite variety of road conditions, weight of vehicles and individual preference, rendering the tire and wheel question one to be most carefully studied by the manufacturer.

To meet these varying conditions manufacturers are giving purchasers an option in wheels and tires, permitting them to choose those best suited to the roads where the vehicle is to be used, or to gratify their individual whims if no better reason exists.

Steam Boiler Number.

We have decided to issue our Steam Boiler Number on Dec. 6. It will be an enlarged edition, both in number of copies and in pages, and will contain articles by leading experts and thinkers, new designs in vehicle boilers, new steam vehicles, etc. Any of our readers who have new ideas in this line which they are willing to have published are requested to communicate with the editor as soon as possible. We wish to make a fair and complete exposition of the steam boiler problem in its relation to vehicles, and indicate the lines of improvement which can most advantageously be followed for the future.

United States Consul's Report on the Berlin Exhibition.

Consul-General Frank H. Mason, Berlin, Germany, reports to the State Department on the recent motor vehicle exhibition there. He says:

"In estimating the success of this exhibition, it is essential to remember that automobilism and the manufacture of motor vehicles are of comparatively recent birth in Germany. This exhibition has revealed for the first time how vigorously German engineers and manufacturers have taken hold of the new industry. The exhibition shows about the usual proportion of carriages propelled by electrity, and some form of hydrocarbon motor oil, benzine or gasoline. Large sales have been made, some of the different types having been sold as many as twenty times for future delivery, and it is noticed that for town or city use the electrical carriages have the preference among purchasers, while for country districts and freight and delivery wagons the benzine and gasoline motors have the call."

Licenses Required to Operate Steam Vehicles.

In view of the approaching parade of the Automobile Club, in which several steam carriages are to take part, the Police Commissioners of New York City have issued instructions to the effect that boilers of steam vehicles must be treated like other steam boilers under the law; that they must be tested and those in charge of them must be licensed like other engineers.

At Washington, D. C., where several steam carriages are owned, an intending purchaser wrote the District Commissioners the other day to ascertain their attitude on the question of the operation of steam vehicles in the public streets by parties not duly licensed engineers.

The Commissioners first referred the matter to the board of examiners of steam engineers, and the board reported that in its opinion no one but a licensed steam engineer should be allowed to operate a steam vehicle. Next the matter was referred to the superintendent of the street department, for advice as to whether there existed any practical necessity for a licensed or other engineer on the vehicle. In his report the superintendent of the street department explained that the motive power of the vehicle in question consists of a gasoline burner, a small vertical boiler with a large number of tubes, and a pair of small vertical engines, driving a shaft and sprocket wheel, and, by means of a sprocket chain, the rear axle of the vehicle—in other words, that the apparatus is an ordinary steam boiler and engine, and, as such, would no doubt be governed by existing regulations restricting the use of such power.

At the same time he said he did not believe there was any practical necessity for requiring the employment of a regularly licensed engineer. The boiler is, he stated, of excessive strength, and it is claimed that the burning of the boiler resulting from low water causes only an elongation of the tubes and consequent leakage through the lower crown sheet. This claim he said was supported by an accident which occurred to a motor carriage belonging to a Washington gentleman. The flow of gasoline to the burner being automatically controlled by a pressure in the boiler, the superintendent said some knowledge of the properties of steam and gasoline should certainly be required on the part of any one authorized to operate these vehicles.

The Commissioners then disposed of the matter by adopting the following recommendations: "About two years ago the Commissioners received an application for permission to run a horseless vehicle operated by gasoline, which permission they declined to grant, on the ground that the machinery was likely to make so much noise as to frighten horses. We do not know that this machinery would so operate, but it should be known before permission is granted. So far as having a licensed engineer is concerned, we would suggest that after the petitioner has learned to operate the machine he might himself become licensed, the only expense involved being a fee of $3."

Central Park Exclusion Rule to be Tested.

On Friday afternoon last Winslow E. Buzby and Whitney Lyon, two prominent members of the Automobile Club of America, endeavored to enter Central Park in an electric carriage, the property of Mr. Buzby. Admission was refused by the Park police and Mr. Buzby was arrested.

The Park Board has never passed any rule forbidding the use of automobiles on the drives, but President Clausen has merely given a verbal order to that effect, and although frequently importuned by owners of automobiles, he has refused to waive his orders.

Mr. Buzby's lawyer, Charles M. Beattie, 253 Broadway, followed in a hansom and accompanied his client to the headquarters of the Park police, where a charge of violating the Park rules and also of disorderly conduct in disobeying an officer was lodged against Mr. Buzby.

When the lawyer asked the police captain what law of the Board had been violated, a clerk of the Department produced a printed copy of the rules of 1873 and read therefrom the following clause:

"The drives shall be used only by persons in pleasure carriages, or on bicycles or on horseback."

A formal charge was entered against the banker and Mr. Lyon furnished the bail bond.

Mr. Buzby was one of the first private citizens in New York to possess a motor carriage, and for more than two years he has had a permit to use the Riverside Drive and other parks hereabout, while Central Park has been barred against him.

It is Mr. Buzby's intention if defeated to appeal to the Supreme Court.

THE CLUB VOTES ITS SUPPORT.

At a meeting of the Board of Governors of the Automobile Club of America, held on Monday evening, the support of the organization was given to Messrs. Buzby and Lyon in their effort to open the gates of Central Park to automobiles.

A committee on laws and ordinances, composed of Avery D. Andrews, Geo. F. Chamberlin and Simon Sterne, was appointed to take up the legal aspects of the test case in the interest of the Automobile Club, and the committee was represented at the hearing in Yorkville Court Tuesday when the charge against Mr. Buzby, who submitted to arrest last Friday, was heard.

Albert C. Bostwick, Winslow E. Buzby and Whitney Lyon were appointed a committee on exhibitions, contests, runs and tours. These gentlemen reported that about 75 automobiles were promised to take part in the first club run next Saturday.

The following statement from Mr. Clausen, president of the Central Park Board, was recently made to the New York Herald:

The power to make rules and ordinances for the parks rests entirely with the Commissioners, one of whom has jurisdiction over each borough. Of course, while it might be dangerous to permit automobiles in Central Park, in Prospect Park or in Bronx Park, where there is not so much traffic, there would be much less danger. When the Commissioner in charge of one of the boroughs suggesgts a rule or ordinance for his borough parks the other Commissioners naturally concur in it. I am opposed to the introduction of the automobile in Central Park.

No action will be taken by the Park Commissioners until the decision is rendered by the magistrate in the Yorkville Police Court on the test case now pending. Of course should that decision be adverse to the Park Board that body can meet and pass an order or rule which will effectually close the gates of the park to automobiles.

The Park Commissioners refused to permit bicycles in the park when they first came into general use, and a test case was made, which was decided in favor of the Park Board. Then the bicycle enthusiasts took the matter before the Legislature and succeeded in having a bill passed which opened the park to the bicycle. The same remedy is open to owners of automobiles.

LONDON NOTES.

London, Oct. 19.

NEXT YEAR'S SHOW.

The motor show to be held at the Agricultural Hall, London, in April next, promises to be a most attractive one. Already a good proportion of the space has been taken up and applications are continually being received. There should be no delay on the part of any American concern which wishes to be represented at the show, as delay may cause a good deal of disappointment.

HORSELESS VEHICLES IN PUBLIC SERVICE.

The most go-ahead automobile city in Scotland is Edinburgh. The Edinburgh Autocar Co., who already possess 18 vehicles, have decided to increase this number to 38 immediately, an order for 20 additional carriages having been placed with the Daimler Motor Co., Coventry. Seventeen of these cars will be fitted with the standard 5½ b.h.p. Daimler engine, and are designed solely for public street traffic. They will carry 10 passengers and the driver. A special carriage will be a 5½ h.p. vehicle for private hiring and touring with small parties. It is designed to seat eight passengers. A 12 h.p. car has also been ordered, capable of carrying 14 passengers, and which will be convertible into a car to carry eight or ten passengers, with baggage and a reserve supply of gasoline for touring. The maximum speed of the new public cars will be 10 miles an hour, and that of the small touring car and the 12 h.p. car 14 miles an hour. The 12 h.p. car will be capable of negotiating with its full load a hill of 1 in 8 or 10, and will be the first of its kind to be introduced into Scotland.

The twentieth vehicle, ordered also from the Daimler Co., is a special one, designed to carry but two passengers, and will be fitted with pneumatic tires, a new water cooling apparatus and wheel steering. Speaking of the Daimler Co., I may mention that they have also just secured an order of six motor wagonettes for the Caledonian Motor Car & Cycle Co., of Aberdeen.

ANOTHER NEW CARRIAGE.

I had an opportunity the other day of inspecting the new motor carriage which is in course of construction at the Ivel works of Dan Albone, Biggleswade, Bedfordshire. The carriage is a four-seated one and will be propelled by means of a Benz gasoline motor. The frame is of tubular construction, while the motor is located in the reverse way to that adopted on the Benz carriages—that is to say, the ignition chamber is at the back of the carriage. Two speed are provided by means of belts working on fast and loose pulleys. Another feature is the adoption of an expanding band brake working inside the two large driving sprockets on the rear axle.

NAMES ON MOTOR CARS.

It is quite possible that ere long a regulation will be enacted requiring all motor cars in this country to have painted on somewhere the name and address of the owner, for during the past week the Standing Joint Committee of the Surrey County Council has addressed letters to the Local Government Board urging that regulations should be issued providing for the more easy identification of light locomotives (motor carriages come under the Light Locomotives on Highways Act. The committee refers to the increased number of motor vehicles and cycles and to the complaints it has received of the undue speed at which many of them are driven, and expresses the opinion that the time has arrived for some regulation to be made as to a denoting mark or number upon all light locomotives, so placed upon the vehicle as to be at all times easily legible. Appended to the letter are a series of extracts from letters received from the chief constables and superintendents of police in the neighboring counties and boroughs in reply to a circular sent by the chief constable of Surrey requesting an expression of opinion on the matter; these are practically unanimous as to the advisability of an addition to the regulations in the sense indicated.

PRACTICAL TESTS OF MOTOR VEHICLES.

The practical side of the Automobile Club of Great Britain has again been made evident by the announcement that the club has made arrangements by which manufacturers, agents and owners of motor cars and cycles may at any time submit the same for trial, the former (1) to a hill-climbing speed test, (2) a 100-mile run, and the latter (3) to a speed test on a racing track. The hill-climbing and 100-mile trials are to be made either in the London or Birmingham district. Certificates will be issued to competitors, setting forth the actual results achieved, a small fee being charged to cover expenses of the trials and certificates. I am glad to note a condition in the arrangements that no speed beyond the legal limit will be permitted or recognized by the club. Already several carriages have been entered for trial. There is plenty of similarly good work ahead for the American Automobile Club.

THE LIVERPOOL SELF-PROPELLED TRAFFIC ASSOCIATION.

The annual meeting of the Liverpool Self Propelled Traffic Association was held on Monday last, when a very satisfactory report was presented. The most interesting items in the report related to heavy motor vehicles.

The results of the second series of trials with wagons of this type having made it clear that an interval of 12 to 18 months admits of much progress being made in improvements upon the construction of motor vehicles for heavy traffic, it has been decided to organize one more series of trials. It is intended that these shall be held in October, 1900, and the association considers that there is little doubt that it will then be justified in leaving the movement to private enterprise for development upon commerical lines.

The council adhere to the resolution contained in their second annual report, viz.: "Resolved, That the Liverpool council of the association is of opinion that the existing maximum of 3 tons tare imposed by the Locomotives on Highways Act, 1896, very seriously hampers and in many cases prohibits the construction of vehicles of the types required for the heavy traffic of this district, and a recommendation is hereby made to the general council that the whole forces of the association shall be immediately directed toward the obtaining of an amendment to the act whereby (a) all restrictions upon weight shall be removed; or, if it be deemed inexpedient to remove all limitations, (b) a limit upon the total moving weight, or upon the weight per axle, shall be substituted for the present limit of 3 tons tare; or if it be considered imperative to retain a limit upon the tare, (c) the tare permissible shall be increased to at least 4 tons."

The council are of opinion that, even if some manufacturers can build a vehicle to carry 5 tons which shall tare less than 3 tons, it is desirable to have the act altered to permit of a 4-ton tare, (a) to insure a reasonable life in regular work; (b) to avoid years of delay in waiting for that lightness of construction which may come ultimately; (c) to give a wider scope to manufacturers who, however, will be prevented from wasting material or introducing excessive weight by the spur of commercial efficiency, which demands the highest possible ratio of live load to tare; (d) to provide for loads of 6 to 10

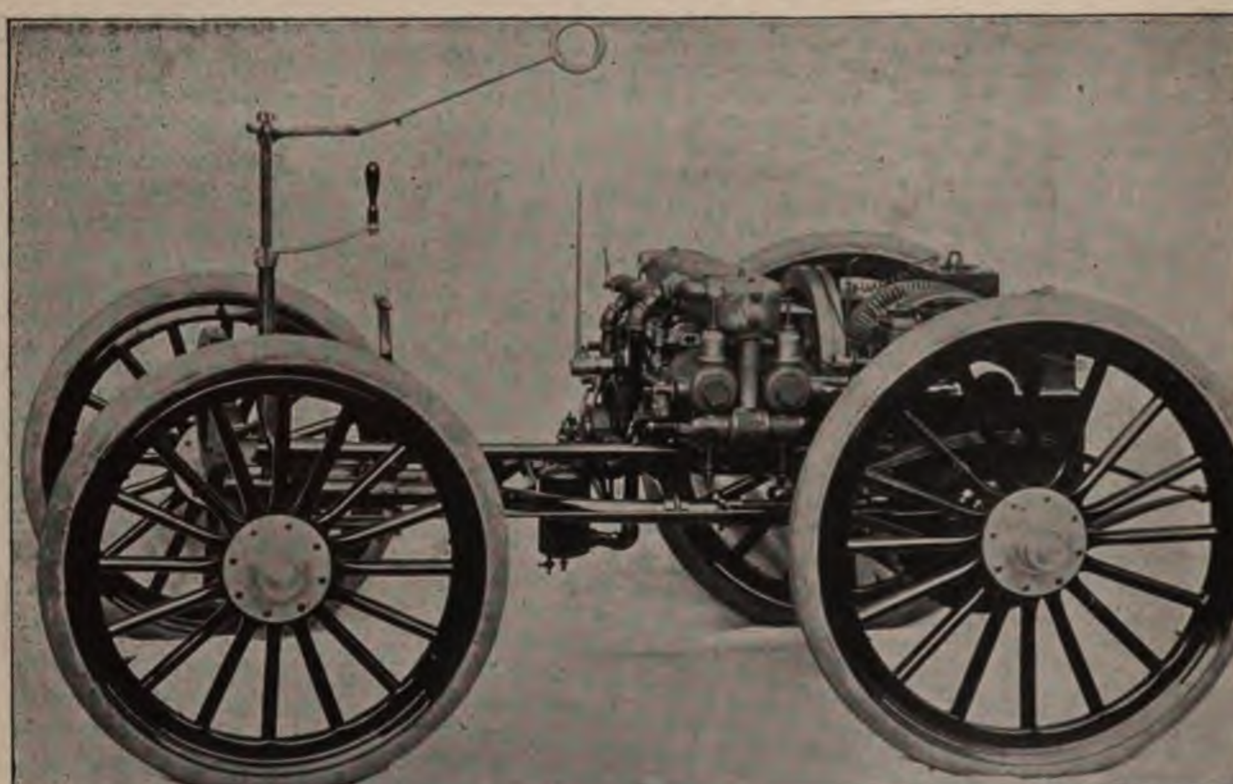


FIGURE 3. ELEVATION SHOWING MECHANISM.

The motor rests on a frame entirely independent of the body, which can be removed by unfastening six nuts and disconnecting the gasoline pipe.

Transmission is by direct gearing. On the end of the motor shaft is securely fastened a rawhide bevel pinion, which engages with two clutch gears, one for forward, the other for backward motion, working on a hollow countershaft containing a rod connected to two clutch collars. Screw racks engage with bronze pinions fastened to shafts having right and left hand threads, which by a rotary movement throw in and out clutch shoes bearing on the inner surfaces of the rims of the bevel gears. This mechanism is easily adjusted by turning the screw racks half a turn or more after removing the cotter pins. On one end of the countershaft is the normal speed gear and on the other the hill-climbing gear. The driving gears on the rear axle are thrown into and out of engagement with it by means of a positive clutch. When the normal gear is in, the hill climber is out of gear. On the rear axle is the customary compensating gear into which the gears on the rear axle clutch. On the outside of the compensating gear is a band brake acting on both wheels. Broad patents have been taken out on the above friction clutch, motor and frame.

The air supply to the motor is controlled by an auxiliary air valve in order to allow for the various grades of gasoline that may be found in practice. This valve is controlled by a handle in front of the seat. The other controlling devices are a single pivotal handle for steering and regulating speed, a gear-shifting lever below on the same standard, a pedal brake in floor and a graduated disk valve for changing the speed of the motor. If the operator bears down on his lever the carriage moves forward; if he increases the pressure the clutch shoes are thrown in accordingly and the speed is increased. If the lever is raised the carriage moves backward. The handle is adjustable to the convenience of the driver and may be raised or lowered at will or thrown forward out of the way. On it is a push button that rings an electric bell.

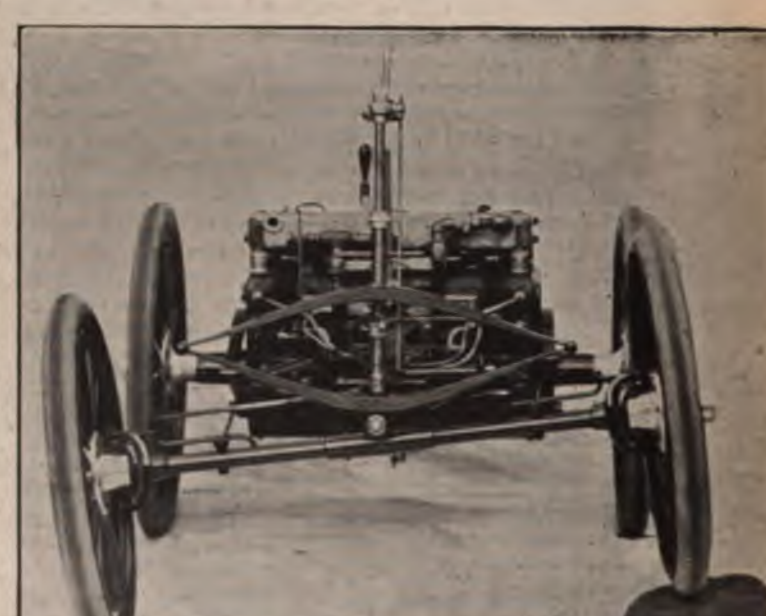


FIGURE 4. FRONT SUSPENSION.

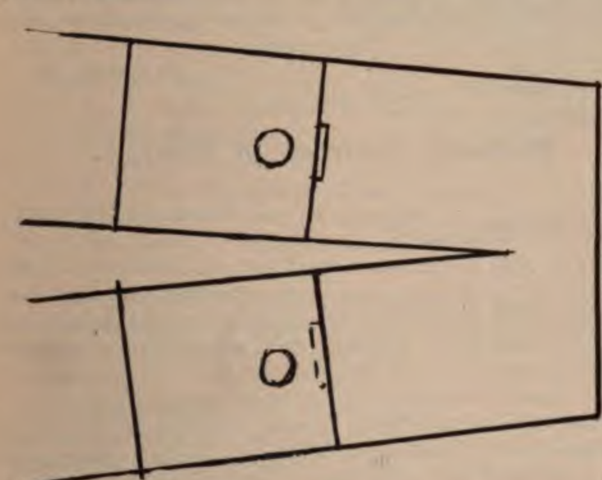
COMMUNICATIONS.

Rhythm in Gasoline Motors.

New York, Oct. 24.

Editor Horseless Age:

The subject of vibration in the gas engine is an interesting one. While a motor should be properly balanced mechanically, no doubt, the chief difficulty to overcome is the vibration caused by the sudden increase of pressure when the charge is exploded. Now it occurs to me that while a heavy fly wheel will make the motor run with more regularity, will not the vibrations be less with a lighter fly wheel, when we consider that it is the resistance of the fly wheel against which the explosions work?



As the vibrations are caused by the explosions, it follows that the larger the cylinder the heavier will be the vibrations, and that therefore four cylinders will give less vibration than two cylinders of equal combined capacity. I have been using a four-cylinder engine and find the vibrations very slight. I find, however, that the matter of rhythm in the explosions has a great deal to do with it, as if, from any cause, there happens to be any irregularity in the explosions in the different cylinders there is a decided increase in the amount of vibration.

Mr. Schaum asks for criticism of his design. Well, it seems to me that the number of gears necessary is a decided objection, and to balance his motor properly he should have two more cylinders opposite the others. I would suggest that he run the two ends into one explosion chamber, like sketch, and that if he intends to have an explosion every revolution one piston be placed say ¼ in. in advance of the other, this latter one opening the exhaust ports and the other the inlet ports. Yours truly, H. RUSS.

Importance of Light Moving Parts in Balanced Engines.

St. Joseph, Mich., Oct. 27.

Editor Horseless Age:

The subject of balanced engines has been gone into pretty thoroughly, and the essential points have been very intelligently touched upon by several of your correspondents. My own judgment is that the balancing of the reciprocating motion of the piston can easily be obtained, but is never obtained except at a cost which outweighs in construction, cost and complication the advantages that can be gained in a commercial engine. The main source of vibration in an engine with the lightest possible reciprocating parts is torque from the explosion. In practice it cannot be absolutely balanced, but on a motor vehicle the proper placing and aligning of the motor may minimize the disagreeable effects to such an extent that while in motion it becomes imperceptible.

The crying need I have noticed in all American designs of gasoline and steam engines is the necessity for light moving parts such as pistons and connecting rods. For instance, the lightest piston on a 1 b.h.p. engine that I know of weighs nearly 4 lbs. (many weigh 10 to 15 lbs.), and the lightest connecting rod weighs 3½lbs. (usually 6 to 8 lbs.). Perhaps 10 to 14 oz. is all the metal absolutely necessary, and I have a commercial engine (not for a flying machine) in which the connecting rod weighs only 3-10 lb. and the piston 52-100 lb.; yet it gives over 1¼ b.h.p. This particular reduction in weight minimizes the vibration to something less than one-tenth as much as when the ordinary methods are followed, and it has the advantage of adding nothing to the complication or liability of breakage, and but little to the cost.

A. M. HERRING.

More Weight.

Pittsburg, Pa. Oct. 25.

Editor Horseless Age:

While some of our designers of motor vehicles are beginning to touch the weight problem, we think there is not enough importance attached to this very essential factor in motor and vehicle construction. It is not our intention to refer to the lead storage system, for we all know they have weight enough and to spare—even to a mill stone about their neck—but to the prime motors; and first in this class the internal combustion motor, and second, steam. We see advertisements and descriptions of gasoline and steam vehicles weighing less than 500 lbs. to carry two persons. Now, this sounds very nice, and these light rigs are pleasing to look at with their light wire wheels, as compared with our foreign cousins' designs; but we imagine we see these fairylike things traversing the country thoroughfares in the western end of our State, where grades of even 30 per cent. are not an uncommon bump to try to mount. I doubt whether a 500-lb. rig could mount these on a wet day without slipping or skidding for want of weight sufficient to give the required tractive force; and they are without structural material ample to withstand the shocks of crossing the water breakers and hitting an occasional boulder, for he is a rare driver who can miss all the stones, especially at a 15 or 20 mile pace.

Framework must have sufficient weight to give strength with a large factor of safety for this exacting service; bearings must be of ample size, gears have liberal faces and not too fine a pitch, with webs and hubs well proportioned. Wheels, springs and axles must be of sufficient weight to stand a short turn at high speed and not throw the dish out of the wheels nor crack or rupture an axle; and not only weight, but good workmanship, with a band and wheel brake accessible and very powerful.

Engines should be at least 2 h.p. stronger than is the present custom, with all bolts and nuts on reciprocating parts not only jammed but drilled and cotter-pinned above nuts, so that if the nuts come loose the pins will hold and save not only the nuts, but perhaps the engine from going "through herself."

Abolish all light and delicate parts, as they are not to be considered in successful motor vehicle construction. Study simplicity, so that great mechanical skill may not be required to make the wear and tear adjustments, and alter the mixtures on the internal combustion type, and, last but not least, manufacturers should give, either by circular or verbally, the most minute instructions regarding adjustments and successful operation. The sooner the buying public are educated the better for all concerned and the less trouble the manufacturers will have after they have got their money, for purchasers will expect the maker to father his own product.

F. C. TYGARD.

Nut Fastenings.

Milwaukee, Oct. 25.

Editor Horseless Age:

We were very much interested in the article on "Loose Nuts," by R. I. Clegg, your mechanical editor. Naturally, in pushing our elastic self-locking steel nut, we have run across at times most, if not all, of these different devices for fastening nuts, but the one item about most of them that prevents their practicability is that in nine cases out of ten the cost of the fastening is more than that of the nut itself.

The self-locking feature of our elastic nut practically costs nothing, as we furnish the nut at the same cost, or even less, than the ordinary nut, and the self-locking feature is entirely obtained by tapping the nut a little smaller than the bolt, so that in being wrenched on it grips the bolt enough to hold it from ever working loose. We are furnishing large quantities of these for railroad work, where they are especially desirable, and it may be that later on we shall work into the trade represented by your publication. Yours truly,

NATIONAL ELASTIC NUT CO.,
Per T. L. Paine, Mgr.

How Many Wheels?

Albany, N. Y., Oct. 25.

Editor Horseless Age:

I have read with interest the several articles published in your valuable journal in regard to three-wheeled vehicles. In last week's issue I noted the comments of Messrs. Duryea and Bramwell. The only advantage of the three-wheeled vehicles is that one wheel is easier to steer than two wheels. The single drive wheel, I think, is more of a disadvantage than an advantage. For instance, if the rear drive wheel were in a ditch and could not work its way out, the operator would be stalled, but with two drive wheels one would not be in the ditch, and would thus help to propel the vehicle.

As Mr. Bramwell says, a four-wheeler properly built has its frame swiveled in the center of the front axle, and he does not see any difference whether a wheel or a swivel is employed at that point so far as stability is concerned.

Now this may all be true in going straight ahead, but if we turn a sharp curve at a high speed the three-wheeler is certainly more liable to upset than the four-wheeler, as the extra wheel on the outside of the arc (which is formed when the vehicle turns a curve) decreases the danger of upsetting, and this is truer of a vehicle of a long wheel-base.

I believe a single steering wheel is superior for turning out of ruts and car tracks, but on a country road the front wheel does not track, but must run over all obstructions such as snow, mud and stones that chance to be in the center of the road. But with a four-wheeler when going straight ahead the rear wheels follow the track of the steerers.

In my estimation a motor carriage should have four wheels, the front wheels serving as steerers and all four wheels as drivers. By this arrangement, if one pair of wheels are ditched the other may not be. As Mr. Bramwell says, custom proves nothing to the designer of vehicles, but common sense does. Yours truly,

F. J. MILLER.

Primary Sources of Energy.

Pittsburg, Pa., Oct. 30.

Editor Horseless Age:

Having read with much interest your late editorials on the relative merits of the various means of automobile propulsion, we were much pleased with the straightforward and unbiased manner in which you analyzed their various claims, but feel that you were scarcely accurate in your classification of prime motors. Would it not be much more accurate to say we have at this time three sources of power or energy in common use? To enumerate: First, we have heat energy produced by the process of combustion; second, we have a source of energy in the attraction of gravitation, and third, the energy derived from the natural currents of air and water, but as these currents are largely produced by gravitation, we may treat them under that head.

As the last mentioned sources of energy are intermittent either in regard to time or location of availability, it will be necessary to await the advent of a successful and economical form of energy storage and transmission before they can become even a possible competitor of the first named source.

We now see that we have practically but one source of energy or power, viz., heat produced by combustion. To utilize this energy in a mechanical manner requires its conversion into either a torsional or an alternate tensile and compression strain exerted through space.

The machine, therefore, that transforms the energy, as above, in one conversion, must be accorded a separate and higher place than the machine that accomplishes the same result only after the second conversion.

The writer would divide the machines above referred to into three classes. In the first class he would place internal combustion engines, in the second class he would place steam engines and in the third class electric machines, air compressors, etc.

P. L. TYGARD.

At the international competition for electric vehicles held recently at Berlin, Germany, the first prize was awarded to Jacob Lohner & Co., carriage builders, of Vienna. The Columbia electrics were the chief competitors.

MINOR MENTION.

Fred Jacks, a bicycle repairer of Napa, Cal., has completed his 500-lb. gasoline carriage.

Experiments are being made at Detroit, Mich., with a three-wheeled motor mail carrier.

The Apex Wheel Co., Rochester, N. Y., has been incorporated, with $10,000 capital stock, to make and sell automobiles, etc.

The American Roller Bearing Co., 27 State St., Boston, Mass., have issued their new catalogue, descriptive of the A. R. B. bearing.

W. D. Andrews, H. Trebert and C. A. Benjamin, Syracuse, N. Y., have organized the Syracuse Automobile Co., with $10,000 capital stock.

H. A. House, Bridgeport, Conn., inventor of the "Lifu" steam vehicles, has invented an atmospheric condenser to make the exhaust invisible in cold weather.

A company with $150,000 capital stock has been organized at Webster City, Ia., to manufacture a light motor carriage invented by Smisa Bros., of that place.

The Safety Appliance & Equipment Co. is a new Maine corporation organized to manufacture automobiles. The capital stock is $100,000, of which nothing has been paid in.

C. E. Tower, of Syracuse, N. Y., is the builder of a gasoline trap propelled by a 4-h.p. two-cylinder horizontal motor. The cylinders are 4 x 4 and transmission is by bevel gears and chain.

The Baldwin Automobile Co., of Providence, R. I., has been incorporated under Maine laws, with $200,000 capital stock, none of which is paid in. Horatio Frager is president and treasurer, and the inventor is L. F. N. Baldwin, of Providence.

The law in regard to the licensing of operators of automobiles, which was passed last summer by the authorities of Chicago, Ill., has never been enforced, and some of the local newspapers are agitating for its enforcement because of the increasing use of motor vehicles.

The Pittsburg Motor Vehicle Co. is sending out a circular announcing the purchase of their business by the Autocar Co., which will continue the manufacture of motor vehicles after January 1, on a large scale. The present address of the Autocar Co. is Third Avenue and Ferry Street, Pittsburg.

The United States Automobile Co., Milwaukee, Wis., has changed its name to the Wisconsin Automobile & Machinery Co. The company's office is at 502 Matthews Building. They have in course of construction a steam road buggy to weigh complete 250 lbs. A condenser will be used, patented by E. Detweiler.

The Union Autocar Co. has been organized at Lowell, Mass., to run public motor vehicles through the subrubs. The capital stock is $100,000 and the officers are: President, Daniel J. Donohue; vice-president and manager, John F. Murphy; secretary, James H. Carmichael; treasurer, Eben Stafford. Electric omnibuses to seat 20 passengers will be used, it is stated.

The Goetz-Coleman Gas Engine Co., New Albany, Ind., have perfected an upright, single-cylinder gasoline engine which they believe to be the simplest on the market. They are manufacturing this engine for farm use in two sizes, 3 and 10 horse. They make the remarkable statement that the 3-horse engine gives its full power with the small quantity of one quart of gasoline per hour. It is their intention to organize companies in different parts of the United States in which they will be financially interested.

The Maltby Automobile Co., 10-12 Clinton St., Brooklyn, N. Y., are putting on the market a line of gasoline motors for vehicles and launches, varying in size from ½ to 2 h.p. in jacketless motors and running up to higher powers with the water jacket. Electric ignition is used, and the motors are suited to either horizontal or vertical position. Having a factory available for experimental work, the Maltby Co. are prepared to build any style of carriage to order from owner's drawings, and they also have facilities for storing motor carriages and giving instruction in the management of them.

Parade of the Automobile Club.

The plans of the Automobile Club of America have been changed. The proposed outing will consist of a parade merely, to take place at 2 p. m. from the Waldorf-Astoria down Fifth Ave. to Madison Square and thence up Fifth Ave. to Mount Morris Park, and thence up to Riverside Drive and Claremont, where a luncheon will be served by the club. The return will be at 6 p. m. via Riverside Drive to Fifty-ninth St.

Among the new members are: Edwin Gould, A. R. Shattuck, Frederic C. Stevens, George W. Young, O. F. Crosby, Albert C. Bostwick, John R. Hegeman, Jr., Joseph A. Blair, Gilbert W. Blanchard, Alfonzo E. Pelham, Col. Albert A. Pope and Walter E. Frew.

Motor Vehicle Regulations in Belgium.

The accidents which have caused so much popular and press agitation in Brussels, Belgium, have resulted in legislation on the subject of carriages and automobiles, says United States Consul Roosevelt, at Brussels. According to these rules all motor carriages not bearing the regulation number of the province must carry the owner's name and address. All automobiles and motor cycles must carry, both in front and behind, a number large enough to be seen at a distance, and after sunset each number must be lighted by a lamp. All automobiles and motor cycles, without exception, must be provided with a brake. The maximum speed allowed is 30 kilometers (18.64 miles) an hour in the open country, and 12 kilometers (7.46 miles) an hour in towns. Rubber-tired carriages must carry bells.

OUR FOREIGN EXCHANGES.

Simpson & Bodman Steam Lorry.

In Messrs. Simpson & Bodman we find the association of the engineer and the carriage builder, both partners having had long practical experience in their respective professions. Hence it would seem at first sight that their combined experience would have enabled them to quickly solve the problem of the construction of an efficient steam vehicle. They, however, found that before they could make the manufacture of such vehicles a commercial affair they had to abandon all preconceived ideas and work out their own design from experimental data. A very interesting account of these gentlemen's experiments, failures and successes, marked by truly Lancashire perseverance, will be found in the Automotor Journal for March, 1898. We commend this paper to our readers as affording some indication of the enormous labor and expense incurred. Since that date similar work has been carried out, and at length the design of a steam vehicle has been evolved which embodies the result of this patient and costly experiment and investigation. Messrs. Simpson & Bodman consider that a goods vehicle should in its carrying capacity be as roomy as a horse vehicle used for similar weights, at least twice as speedy, absolutely safe under all conditions of wear, accident or neglect, as powerful for starting and manœuvring as its equivalent horse lorry, and in its prime cost not exceed to the user three and a half times the cost of one horse lorry with its horses and appointments, capable of moving an equal load on any single average journey. In addition, the public will demand that it must not be noisy or unpleasant, nor injurious to the roads; and the maker, if he be wise, will endeavor not to promote adverse criticism by the creation of any designs too strangely contrasting with existing types.

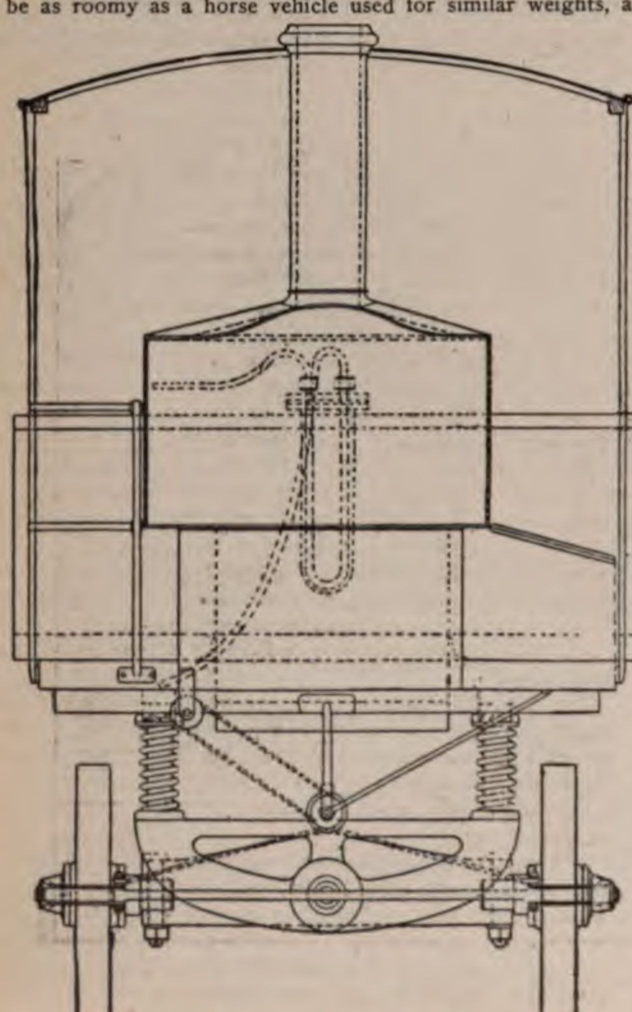


FIGURE 2. FRONT ELEVATION OF LORRY.

On a recent visit to Messrs. Simpson & Bodman's Pomona Engine Works, Manchester, we were afforded an opportunity of inspecting several vehicles of the new design in frame or in course of erection. Two types are being made—the 3-ton and 5-ton lorry. In both the framing is of oak, 17 ft. 6 in. x 6 ft. 3 in. over all, suitably plated and strengthened.

Fig. 1 shows us a perspective view of the framing. The general arrangement of these vehicles is shown in Figs. 2, 3 and 4, Fig. 2 being a front elevation and Fig. 3 a side elevation, while Fig. 4 is a plan of the platform. As will be seen from Figs. 1 and 4, the framing consists of four longitudinals

SIMPSON & BODMAN GENERATOR.

connected by (in the rear) two transverse frames. This rear framing is supported by four plate springs of very deep camber, so arranged that each spring is directly under one longitudinal bearer. To these plate springs is attached the main or driving wheel axle. Each driving wheel is mounted between a pair of springs, and thus the axle is supported throughout its length. The rear axle is a weldless steel tube with the axle arms case hardened and ground true, and it carries four spring bearings, the two outer ones being at the extremities. These bearings are recessed to make dust-excluding shrouds for ball thrust collars for end adjustment to the axle bushes. These bushes are wrought iron run up with anti-friction metal, and are of such a surface that, assuming one-third of the circumerence as carrying load, they can never have more than 150 lbs. per square inch of load on them.

The method of attaching the rear or driving wheels to the framing will be gathered from an inspection of Fig. 5, which shows these details very clearly.

Lubrication is assured by filling the axle for 18 in. from each end with solidified oil and providing an oil hole in the base of the arm.

The fore part of the framing is carried through spring loaded pins attached to a transverse wood framing reinforced with

the air supply by concentrating it by cooling gave more powerful explosions. More explosive mixture, higher compression and more forcible explosions naturally result from introducing cold charges, and the reverse is also true; but it must not be supposed that the temperature at which the charges entered the cylinder was the only reason why the speed varied.

Considering the expansion produced by heating air opens the question as to whether gas and gasoline engines could not often be run in a more satisfactory and economical manner by taking that into account. If a gas engine is started and the feed adjusted in a cold room early in the morning, it is altogether probable that the gas and air will mix in quite different proportions in the heat of the day after the natural temperature, the engine and its surroundings have reached their maximum temperature. When the engine is in a small room and the cylinder is cooled by a tank of running water, the increase in temperature is considerable. If for any reason the room becomes very warm and the gas meter, piping and bag are in a cool cellar and only the shortest possible length of gas pipe is in the warm room, then the difference in mixture must amount to considerable. With gasoline engines the difference produced by a change from cold to warm air is still greater, because even if the gasoline is heated to the temperature of the air its expansion because of heating is almost nothing.

Jacketing the air suction pipe with cold running water would keep the temperature of the air both uniform and cold. In cases where the cylinder is cooled by running water it could be first used for cooling the air.

Gas Engine Vibrations and Balancing.

By E. J. Stoddard.

There seems to be a hopeful interest in this subject at present.

Permit me to venture the following suggestions:

Forces that are entirely within rigid apparatus are balanced. We will therefore consider them only incidentally.

There are two ways by which a vibration may be produced in a properly constructed vehicle.

First, by a force acting upon the vehicle and roadbed; second, by a force upon the vehicle accelerating, positively or negatively, some movable part thereon.

The first way has occasioned but little trouble except to the dividend paying people who hang to straps in the electric cars.

The effect is proportional to the force tending to move the vehicle and inversely proportional to the weight of the vehicle and load. One may base his judgment upon this class of effects by reference to his experience on electric cars. The maximum disturbing force that he has experienced when the car started is due to a ratio of about one-fifth of the propelling force to the load, or about 30 lbs. to the individual.

The second way is of more pressing interest.

We will consider two classes of vibration due to the inertia of movable parts of the vehicle, one class due to the acceleration of the reciprocating parts, the other due to the acceleration of the fly wheel.

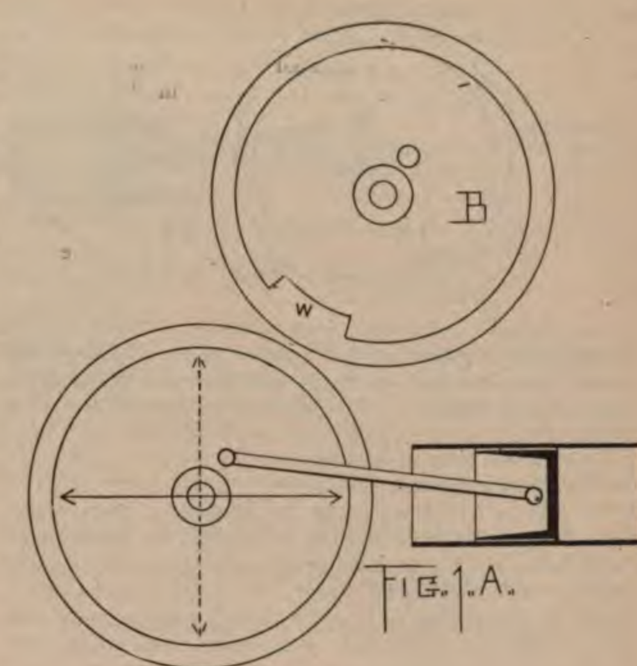


FIG. 1. A.

I.

THE RECIPROCATING PARTS.

The theory relating to the forces due to the reciprocating parts of an engine we have at hand in most any book upon the steam engine. We will briefly recapitulate it here for the sake of future reference.

It is simply that the effect of the reciprocating parts in the direction of their motion is approximately the same as if their entire weight was concentrated upon the crank pin.

Thus in Fig. 1 A the effect of the change of speed of the piston and connecting rod in the direction of the arrows is the same as if a weight, W, equal to the weight of said parts, was concentrated upon the crank pin. We may therefore completely balance this effect by placing a weight upon the fly wheel, opposite to the crank pin, and equivalent to the reciprocating parts, as in Fig. 1 B. When we have done this, however, we have only exchanged one evil for another, for now, while we have no vibration in the direction of the arrows, Fig. 1 A, we have introduced an equal vibration at right angles thereto, as indicated by the arrows in broken lines, Fig. 1 A.

To borrow an expression from the electricians, the force of the introduced weight may be represented by a rotating victor of constant length, and the effect of the reciprocating parts by the corresponding alternating victor.

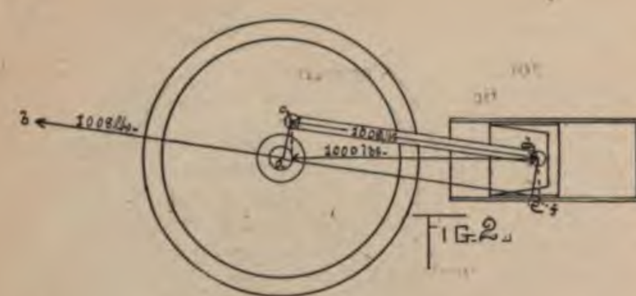
The practice is believed to be to balance half of the effect of the reciprocating parts and introduce an equal transverse force.

II.

THE FLY WHEEL.

Let us at first consider that the fly wheel is unconnected with the running gear.

Referring to Fig. 2, suppose that there is a force of 1,000 lbs. acting upon the piston. It produces a somewhat greater force upon the connecting rod, owing to the slant of the rod. The force upon the connecting rod at the fly wheel end may be resolved into a moment equal to said force multiplied by its



perpendicular distance from the center of the fly wheel, and into a force equal to it and in the same direction acting at the center of the fly wheel. See Weisbach's Mechanics, Vol. 1, pp. 575-576.

The resultant moment is represented by the area, a c d e, and the force by the line a b.

The force a b is balanced by the resultant of the pressure upon the cylinder head and the pressure of the piston upon the cylinder, and the moment produces an equal and opposite moment upon the engine frame. This last may be represented by the pressure (d f) of the piston on the cylinder, into a lever arm, a d. This area is evidently equal to the area a c d e.

The vibration due to this last mentioned cause is what we feel so distinctly when the engine is allowed to run disconnected from the running gear.

If one doubts these results he may diagram the forces and moments at each end of the engine to scale. Both moments are about the crank axle as a center. It will be seen that the forces are equal and opposite and upon rigidly connected parts, and that the moments are equal and opposite and upon parts that are free to move with reference to each other—that is, they do not balance each other.

When the fly wheel is rigidly connected to the running gear its acceleration is much reduced thereby and consequently the vibration due to this cause is also reduced. Lost motion between the engine shaft and driving gear may therefore have a very important effect.

A BALANCED ENGINE.

If an engine had two cylinders side by side, each cylinder having its own fly wheel equal in its moment of inertia to the other; if the two fly wheels were so geared as to turn in opposite directions at the same angular speeds, both cranks being on the same dead center at the same time, and if the iginition of the charge occurred at the same time in each, as, for instance, in a chamber communicating with the explosion chamber of both cylinders, and if, finally, the inertia of the reciprocating parts is balanced by an equivalent weight placed opposite the crank pin, such an engine would be practically balanced.

Balancing of Motors.

By H. E. Wimperis, Wh. Sc.

I.

Perhaps the most frequent complaint brought against motor cars is that they shake and vibrate quite excessively, even absurdly—and surely the sight of an impatient, panting car waiting outside a man's house must appear humorous even to the most casual observer. Of course, not all cars can have this charge brought against them, and even with regard to those to which it can apply, one must remember that the problem of balancing a high-speed motor in a cramped position is by no means a simple one, and it is the object of these articles to deal with the points that are most important in connection with balancing motors, so that this vibration may be reduced even if not annihilated altogether. It is not difficult to find out what it is that is responsible for most of the vibration; one only need suspend the car in the air (as is frequently done to locomotives), and set the machinery going. In suspending the car it is well to remember that the primary reason for slinging the car up is to render the effect of gravitation as little troublesome as possible, and that therefore the car must be suspended in such a way as to leave the position of the motor with reference to wheels, springs, etc., as much like the working condition as possible.

Railway locomotives are usually slung up from both ends, but we will suppose the car suspended from one point only, as then the description is simpler.

Fig. 1.

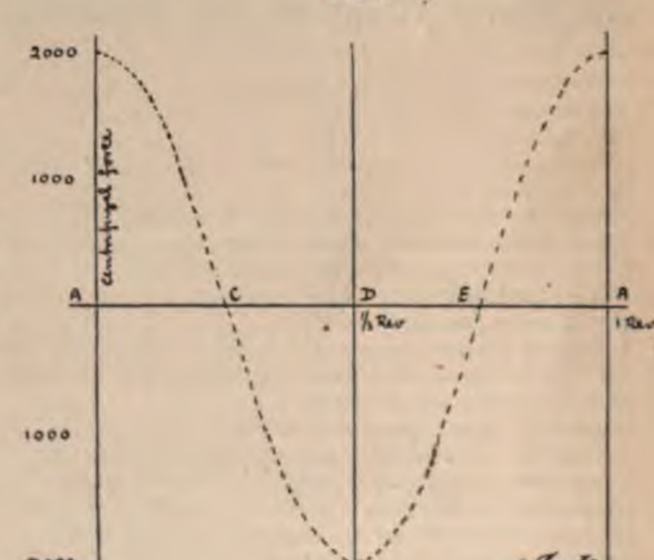


Fig. 2.

The first point to be considered is, in how many ways can the car move? It may move vertically, horizontally lengthways, horizontally sideways, twist about a "vertical" axis, twist about a "longitudinal horizontal" axis, and lastly, twist about a "transverse horizontal" axis.

Thus there are six kinds of motion, and any sort of jumping, vibrating or tossing can be reduced to a small portion of all or part of these six fundamental motions. As the car will be of some weight the vertical motion will not be very large, but its effect might be great, for suppose the car weighed 2 tons and the motor was out of balance to the extent of giving first a push up and then a push down to the extent of say half a ton, the pressure of the wheel on the ground in running would be constantly varying between 1½ tons and 2½ tons, which would be extremely unpleasant and would cause slipping of the wheels. The horizontal lengthways motion would be noticed, as the speed of the car would be made to vary by perhaps 10 per cent. five times a second in a bad case of a totally unbalanced engine; the other horizontal oscillation, being sideways, would be less bother, as the tires would probably take most of it up.

As to the twisting oscillations, the "vertical" would be most dangerous, as it would affect the steering; the "longitudinal horizontal" would be less obnoxious, and the "longitudinal transverse" would have the most unpleasant effect in appearance, as it would mean the rocking of the car on the springs. Thus the six motions are all accounted for; drawings in three dimensions are not very clear generally, and therefore recourse has to be had to a somewhat lengthy description.

One may as well admit that it is out of the question to balance all these six forces and couples, and what one has to do is to get rid of the most troublesome and make the rest as small as possible. It is that property of matter known as inertia that has to be dealt with in all problems in balancing machinery; it is a kind of inanimate laziness—masses of all kinds take time to get up speed. Thus, suppose a mass of 1,000 engineers' units (its weight therefore is 32,000 lbs.) were to rest on a smooth plane and a child were to push at it with a force of 5 lbs., we know that in time this huge mass would get up to very great velocities (the plane being quite smooth), but it would take 20 minutes' pushing before that mass got up a velocity of even four miles per hour, and that is disregarding the effect of friction—this shows the effect of inertia. Similarly, if the mass had to be stopped by a small force, it could not be done all at once. Mass is, or should be, always reckoned in engineers' units—that is, simply this: Take the weight in pounds and divide by 32 (more accurately 32.2 and called g), and you get the mass in engineers' units. If mass be always kept in these units the result to any calculation gives you forces in pounds and kinetic energy in foot-pounds, where

$$\text{Force} = \text{mass} \times \text{acceleration.}$$
$$\text{Kinetic energy} = \tfrac{1}{2}\ \text{mass} \times (\text{velocity})^2.$$

Also all distances must be in feet and time in seconds—no mistake can be made if these rules are adhered to.

When masses move in curves instead of straight lines, centrifugal force is introduced, and the formula for that is—

$$\text{Centrifugal force} = \text{mass} \times \frac{(\text{Velocity})^2}{\text{radius}},$$

and the above rules as to units apply here. Radius is the radius of the circle in which the body moves, or the "radius curvature" if it is moving in any other form of curve. Now, in Fig. 1 we have a mass, m, moving in the circular path shown (the radius of the circle is r), then its centrifugal force is $= m\dfrac{v^2}{r}$, where $v =$ its velocity in feet per second. To concentrate attention, put $m = 5$ (that means its weight must be 160 lbs.), $v = 20$, and $r = 1$ ft. (evidently that means $\dfrac{20 \times 60}{2\pi} =$ nearly 200 revolutions per minute), and centrifugal force $= 5 \times \dfrac{400}{1} = 2{,}000$ lbs. Also it is necessary to know the horizontal component of this force; when the mass is at A or D the centrifugal force acts outward, and is horizontal and equal to 2,000 lbs.; but when it is at C it acts vertically and the horizontal part is zero, so that the horizontal component starts at 2,000 lbs., sinks to zero, and rises to 2,000 again (in opposite direction) every half revolution—in fact, the horizontal part is proportional to cos θ, as in Fig. 2. this is analogous to the case of piston and crosshead.—The Automotor.

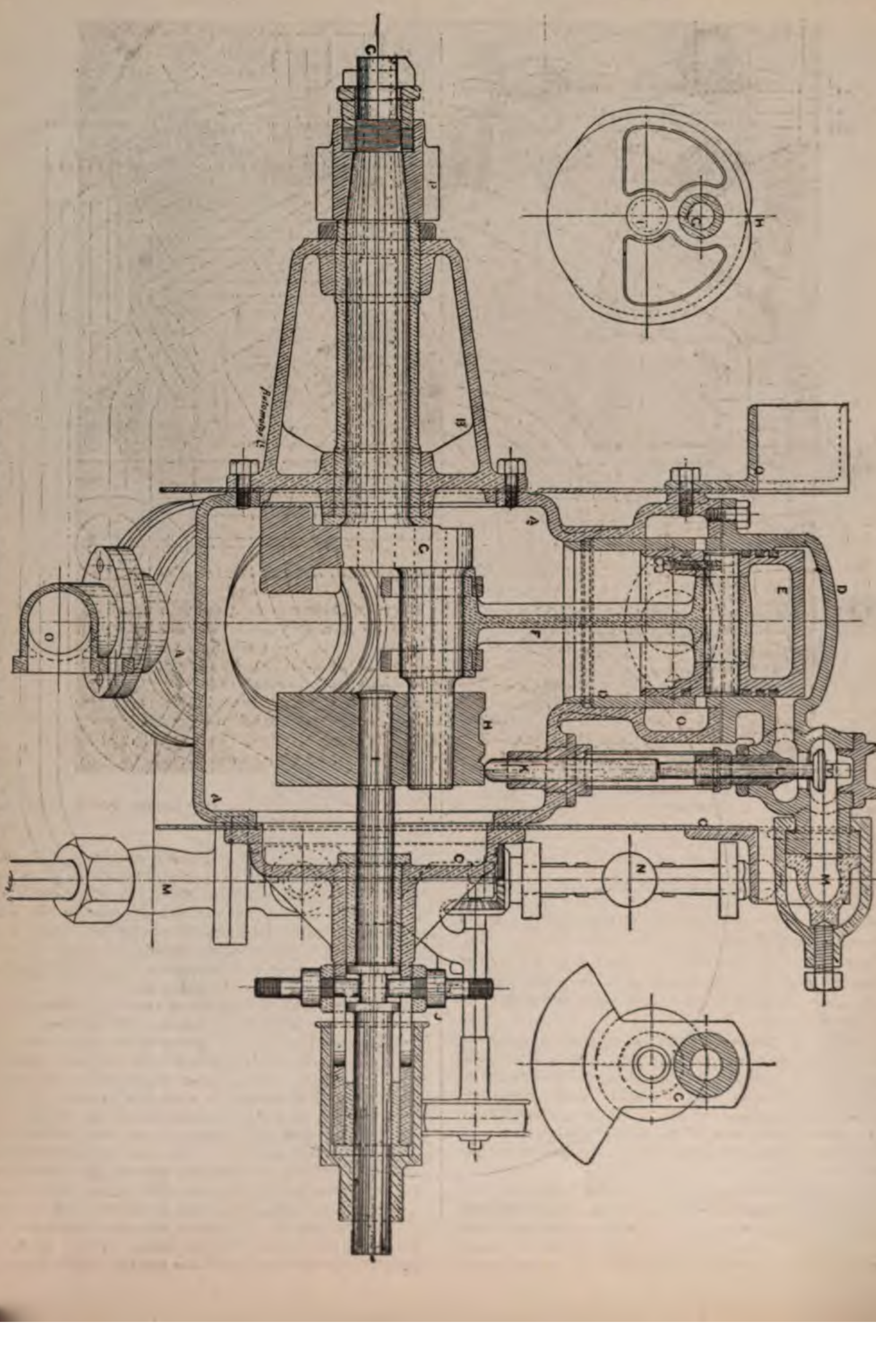


FIG. 7.—THE SIMPSON AND BODMAN STEAM LURRY (Longitudinal Section of Motor).

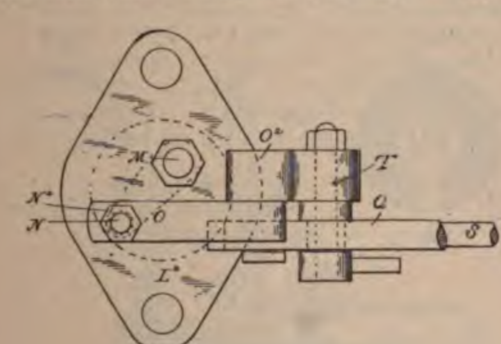
MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 635,506—Electric Igniter for Gas Engines.—Ransom E. Olds, Lansing, Mich. Application filed April 20, 1898.

Claim.—In an electric igniter, the combination with the ignition chamber and fixed electrode inclosed within said chamber of a longitudinally sliding electrode projecting into said chamber and adapted to contact with the fixed electrode, a stop on the outer end of said sliding electrode, a lever, one arm of which loosely engages said sliding electrode beneath



said stop, a stop on the electrode beneath said arm of the lever, a spring interposed between said arm and last-mentioned stop, a spring urging the lever to withdraw the sliding electrode from contact with the fixed electrode, a stop on the lower end of the sliding electrode to limit the movement of said lever, and means for actuating the lever.

No. 635,620—Motor Wheel for Vehicles.—Julius Wm. Walters, New York, N. Y. Application filed May 1, 1899.

This invention has reference particularly to improvements in the constructions shown in a prior patent, No. 624,414, dated May 2, 1899; and it has for its object to simplify the construction of the propelling mechanism and to provide means for reversing the direction of the vehicle without the use of a reversing mechanism applied to the motor.

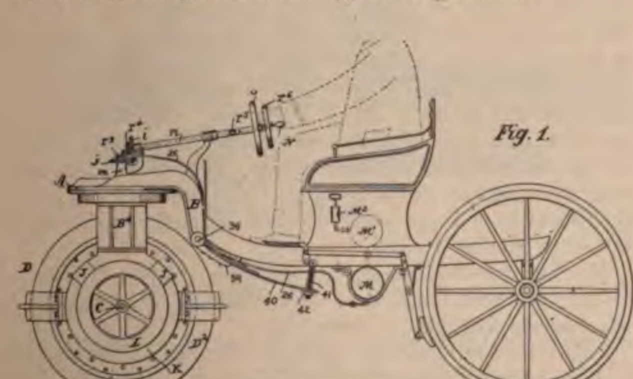


Fig. 1.

Fig. 1 represents a side elevation of a vehicle embodying this improved traction wheel arranged as the front wheel. Fig. 3 is a cross-section.

Fig. 3.

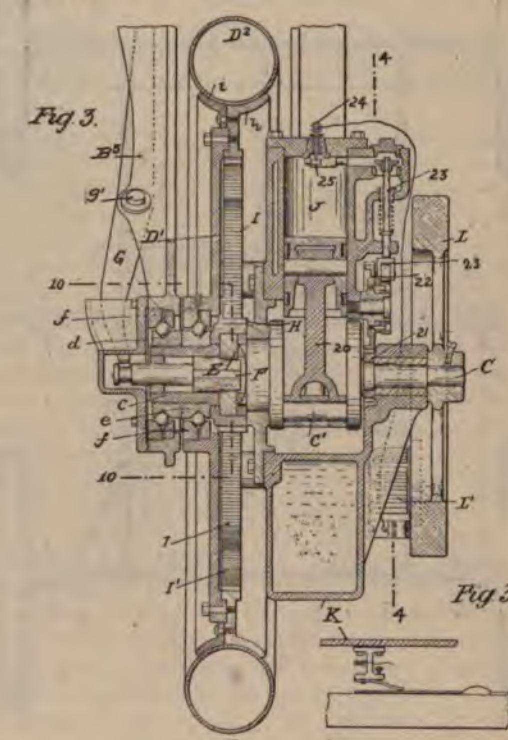


Fig. 3

Claim.—The combination with a vehicle, of hinges fastened to its frame or body, spring cushions connected with the bearing plate from which the wheel and motor are supported and said bearing plate being connected with said hinges, means attached to the wheel for starting, stopping and completely revolving said wheel about a vertical axis without stopping the motor placed within reach of the driver, and said wheel being provided with means for producing a current of electricity for the purpose of igniting the charges of gaseous fuel and also with a pneumatic device for controlling the admission of fuel to the engine—all within reach of the driver or operator, thus forming a complete power wheel for the propulsion of the vehicle.

No. 635,603—Motor Carriage.—William C. Schultze, Buffalo, N. Y. Application filed May 2, 1899.

Fig. 1 represents a plan view, Fig. 2 a section through the center frictional locking portions of one of the rotating drums, Fig. 3 a detached side elevation of one of the center frictional locking portions, the parts being separated from each other and the operating pin removed, Fig. 4 a detached side elevation of the outer shell of one of the drums or pulleys, Fig. 5 a central longitudinal section through a portion of one of the drums or pulleys, Fig. 6 a central longitudinal section through the collar and the tubular driven shaft, showing its longitudinal slot through which the pin attached to the collar projects, Fig. 7 a section through the motor starting device on or about line v v, Fig. 8, and Fig. 8 a section through the motor starting device on or about line x x, Fig. 7.

The motor driving shaft 8 is journaled in the journal boxes 9 on the frame. The shaft 8 is provided with a fly wheel, 10, and a series of pulleys or drums, 11, of different diameters. The driven shaft 12 is supported in the journal boxes 13 on

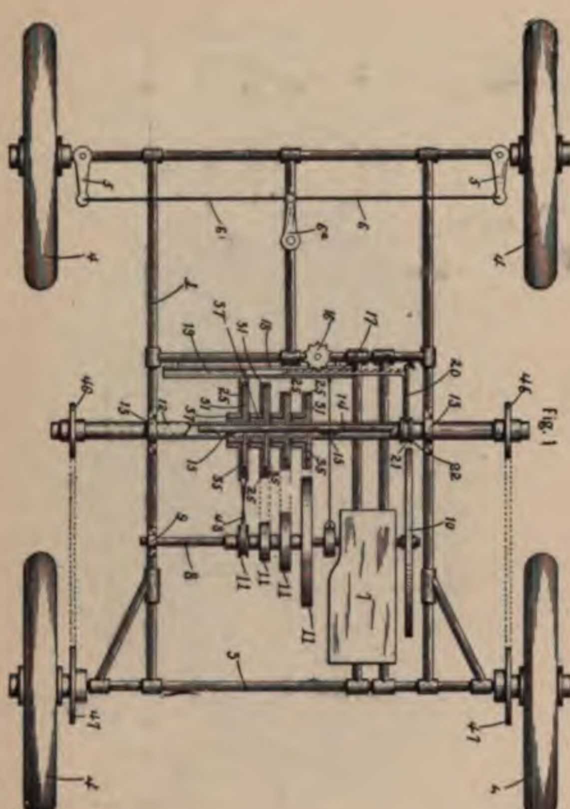


Fig. 1

the frame and is tubular in form. A rod, 14, having one or more enlargements or protuberances, 15, is aranged within the tubular shaft and is longitudinally adjustable therein. The longitudinal adjustment of the rod within the shaft is controlled by a device having a gearing wheel, 16, which meshes with a toothed rack bar, 17, mounted in a support, 18, having a recess or depression, 19, forming a slideway for the rack bar. An arm, 20, extends at susbtantially a right angle from one end of the bar 17 and engages in a peripheral groove or depression, 21, in a collar, 22, mounted upon the shaft 12, and a pin, 23, extends from said collar through an elongated longitudinal slot, 24, in the shaft 12 and into connection with the rod 14.

A series of drums or pulleys corresponding to the drums or pulleys upon the driving shaft 8 are mounted upon the driven shaft 12 and are connected thereto by belts, chains, or similar means. The drums or pulleys upon the driven-shaft are normally arranged so as to rotate thereon, the outer shell 25 being mounted upon inner portions, each of which is formed in three parts, the center part 27 being rigidly fastened to the shaft and substantially circular in formation, except in two places, an extension, 28, projecting from one place and a radial slot, 29, being cut from the central opening 30 in the other place, through which the shaft passes to the periphery. The side parts or segments 31 are duplicates of each other and are arranged one on each side of the center part 27, depressions or recesses, 32, being provided at one end of each segment, into which the extension 28 fits, and the opposite ends being cut away, so that when the segments are assembled an opening, 33, corresponding to the slot 29 is left, being then the outer portions, 34, of the edges of the ends of the segments extending diagonally toward each other to close the opening as they approach the periphery. An operating pin, 35, is mounted in each of the slots 29 and openings 33, and has a leveled outer end, 36, adapted to contact against the diagonally extending portions 34 of the edges of the segment ends.

The outer shells 25 are each provided with short tubular side extensions, 37, of lesser diameter mounted upon the extensions 38, which extend from the center parts 27 and serve to maintain the shells against longitudinal displacement.

The motor is provided with a starting device which is mounted upon the driving shaft and comprises an inner ring, 39, rigidly mounted upon the shaft and having a series of peripheral notches, 40, in which the balls or rolling devices, 41, are placed. An outer ring, 42, is mounted upon the inner ring, and its surface is formed substantially as shown in Fig. 7, being provided with a series of shallow depressions or pockets, 43, into which the balls 41 drop by gravity to prevent independent rotation of the outer ring in one direction upon the inner ring. A band, 44, of flexible material, encircles or partially encircles the outer ring and is fastened at one end thereto, the opposite end being fastened to a lever or similar de-

Fig. 2


Fig. 3


Fig. 4

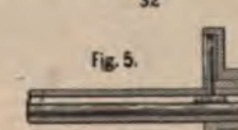

Fig. 5


Fig. 6

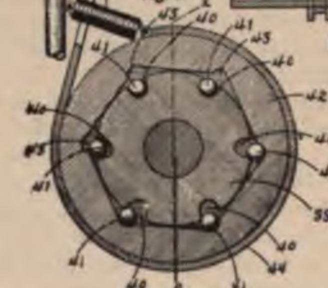
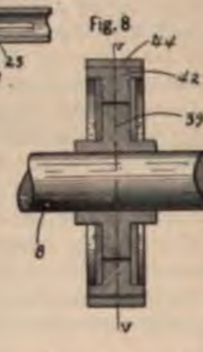

Fig. 7


Fig. 8


vice attached to the carriage frame. A spring, 45, connected at one end to the band and at the other to the frame, serves to maintain the band in the encircling position and to return it to said position and the outer ring to the normal position after said outer ring has been rotated or partially rotated by the unwinding of the band to start the motor. The outer ring 42 is held in its position upon the inner ring 39 by the side plates 49 or rings, which are fastened to the inner ring by screws or similar devices, 50.

No. 635,300—Positioning Apparatus for Motor Vehicles.—George Herbert Condict, of New York, N. Y., assignor to the Electric Vehicle Co., same place.

This invention relates to apparatus whereby a motor vehicle carrying storage batteries is directed into proper position with

respect to mechanical loading and unloading apparatus, so that a tray of exhausted batteries may be removed therefrom and replaced by a tray which has been charged and is ready for use.

No. 635,298—Carbureter.—Ferdinand E. Canda, New York, N. Y. Application filed Dec. 18, 1897.

When an admission stroke of the engine begins the valve 7 is opened by suction and a mixture of air and gas is drawn from the interior of the carbureter through the chamber 6 and pipe 8 into the engine cylinder and air is drawn through the screen 25 and passage 5 into the carbureter. When the valve 7 opens its stem, 9, engages with the collar 17 on the spindle 16 and opens the oil supply valve 12. The oil in the groove or oil carrier 14 of this valve is thus permitted to flow into the main cylinder 1 of the carbureter, where it is absorbed by the wicking; but only the oil which has accumulated in the groove 14 is thus admitted to the carbureter at each stroke of the valve, for the piston 13 of the valve closes the passage 15 as soon as the valve is even partly open, and the valve is opened and closed so rapidly that no perceptible escape of oil can take place while the edge of the groove 14 of the piston 13 is passing across the passage 15. The oil thus admitted into the wick chamber and absorbed by the wicking diffuses itself throughout the mass of wicking, and since the entering current of air must pass through this mass of wicking to reach the outlet chamber the air is brought into very intimate contact with the oil, which exists in the wicking in a very fine

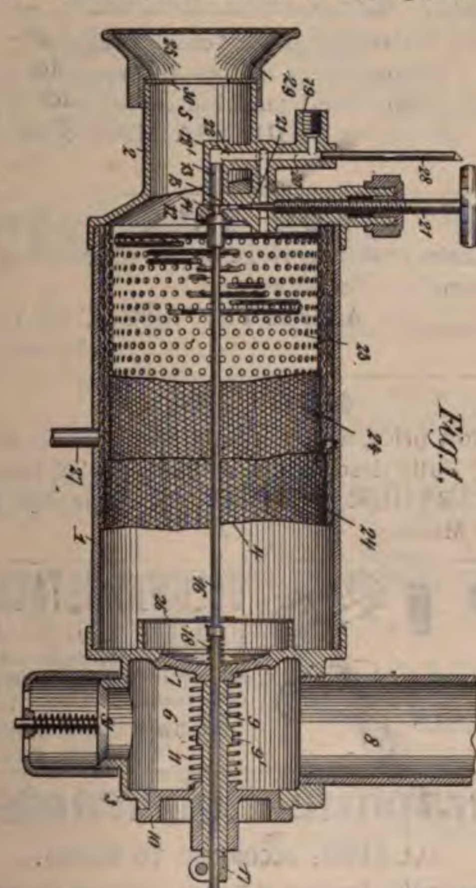


Fig. 1.

state of subdivision, and the evaporation of the oil is thereby facilitated, while the mass of wicking itself acts as a filter to prevent any of the oil being carried into the outlet chamber in a fluid condition. Preferably the carbureter is arranged substantially horizontally, so that any excess of oil in the carbureter collects at the bottom, where it may flow off through a drip pipe, 27, into a suitable receptacle. Since the outlet valve opening is considerably above the bottom of the wick chamber of the carbureter, it is not possible for liquid oil to be carried into the outlet chamber through flooding of the wick chamber.

Preferably the inlet valve of the engine should be operated by a speed governor which does not permit the valve to open when the engine is running above its normal speed, such as an ordinary "hit-and-miss" governor. Where this is the case, the oil inlet valve 12 is opened only when a charge of gas is to be drawn into the engine cylinder. The amount of oil admitted to the carbureter, therefore, is exactly proportioned to the demands of the engine. Since the groove or oil carrier 14 in the oil inlet valve has a definite capacity, the amount of oil admitted to the carbureter at each stroke of the engine may be accurately determined. The size of the groove is that required to admit sufficient oil to run the engine at the maximum power which it is intended to develop; but it is not necessary when the engine is running for a considerable time on an underload that the groove 14 should be completely filled prior to each stroke of the valve. When the engine is to be operated on an underload for a considerable length of time the regulating valve 21 may be partly closed, so restricting the amount of oil flowing into the groove 14, so that less oil is admitted to the carbureter at each stroke of the valve and a "poorer" gas is formed in the carbureter. The gas being poorer, the explosions in the engine cylinder will take place more regularly than would be the case were the gas richer, and the engine will operate more uniformly.

To facilitate the proper adjustment of the regulating valve 21, its hand wheel may be graduated, and a pointer, 28, may be placed in close proximity thereto.

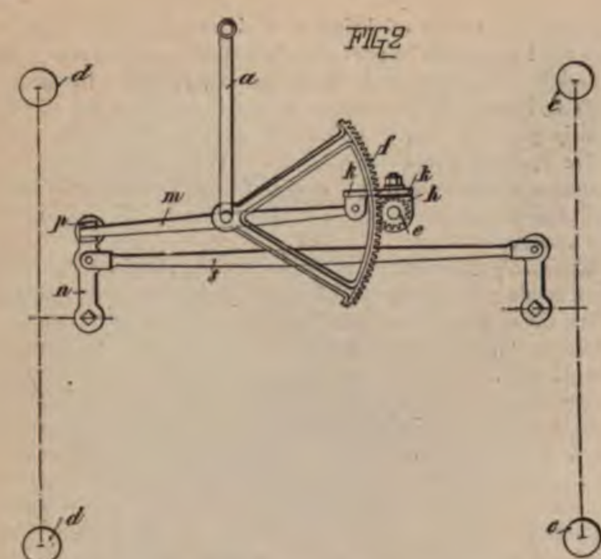
The grade of the oil used in oil engines frequently varies, some oils being heavier than others. It is desirable that the amount of air admitted to the carbureter shall be that best adapted for the particular grade of oil used. For this reason the funnel 29 of the end section 2, which carries the strainer 25, is made removable, so that a perforated reducing disk, 30, may be placed in the passage 5 and held in place by the funnel 29. Fig 3 shows such a disk in place, the screen 25 being broken away, and Fig. 4 shows one of the disks in detail. The carbureter may be provided with a number of these disks having different sizes of openings corresponding to the amount of air required by different grades of oil, and each disk may be marked with a number denoting the grade of oil with which it is intended to be used, as indicated in Figs. 3 and 4, in which the numerals "70" and "80" indicate according to an arbitrary scale the grades of oil with which the two disks shown in these figures are to be used.

In the end section 3 is a relief valve, 31, normally held closed by the action of a spring, which relieves pressure in the carbureter in case a "back fire" or untimely explosion in the engine should take place.

No. 635,654—Steering Apparatus for Motor Vehicles.—Jean Canellopoulos, Courbevoie, France. Application filed May 10, 1899.

There can be no doubt that the straight lever, called the "free bar," for steering motor vehicles, is the easy steering rod, par excellence; but the great inconveniences connected with it render it very dangerous.

FIG 2



It is easy to understand that all the levers employed up to the present time, whatever be their shape, suffer from the inconvenience that when the steering wheels meet with an obstacle the steering rod is violently shaken or twisted, from which many serious acidents have resulted. Further, it is impossible for the driver in charge of the vehicle to rest for a single instant, for if he did so in releasing the steering handle the vehicle will no longer be directed.

In order to make as clear as possible the explantions which are about to follow, I have represented, by way of example, in the accompanying drawings my new system of steering.

The operating lever consists of a bar, a, provided with a handle, b. Instead of acting directly on the wheels c and d, the inventor interposes a gear, e, which is actuated by the lever a through a toothed sector, f. The gear e actuates in its turn its screw spindle, g, which actuates, by means of the screw-threaded nut h, a lever, k, pivoted at l. The lever k actuates, by means of the lever m, the pivated crank or lever n, which effects the movement of the wheels c and d.

The parts p and r are pivoting caps and have the effect of annulling the various movements of the wheels produced in consequence of irregularities of the road surface.

The working of the device is as follows: By turning the handle b in one direction it will turn the sector f with it, which in its turn causes the toothed wheel e to turn, thereby rotating the screw g in the nut h. The lever k thereupon rises or descends, and this movement is transmitted to the road wheels by means of the levers m and n. If one of the wheels d or c meets with an obstacle, this obstacle will turn the wheel to one side or the other, and if the lever a were directly connected to the wheel, as is the case in the present device, the wheel having been turned aside by the obstacle would involve the other through the connecting rod s; but as I have interposed the screw g, this screw prevents the lever k from communicating to the lever a the least movement, and if the wheel encounters any obstacle the effect of the latter will not be transmitted to the steering handle. On the other hand, if the driver is steering in a straight line it is not necessary for him to keep his hand continually on the handle b, but he can leave it free; for with this device the wheels will not deviate from the direction set so long as the conductor does not move them for that purpose by means of the handle b.

The ratio of rise of the screw g should be so arranged that the reactions which the wheels produce on the screw in consequence of the obstacles should not produce any recoil movement.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS

VOL. V. NEW YORK, NOVEMBER 15, 1899. No. 7.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

000,000,000,000.

The end is at hand. "Whom the gods would destroy they first make mad." Having been detected and foiled in their financiering enterprises of earlier origin, the promoters, with Protean swiftness, have appeared in a new guise, and are girding themselves for a new attack on the public purse. The modest little companies of $10,000,000 and $25,000,000 with which they juggled at the beginning of the year have been abandoned as too small for their mature ambitions (as indeed they are at the present rate of shrinkage); and colossal schemes of 75,000,000-dollar and even 200,000,000-dollar combinations haunt their feverish imaginations. Bedlam is broke loose into the motor business.

The first chapter of motor romance which appeared the past week, and which is now being served up as a serial by the daily press to whet the public appetite for sensation, pertains to the incorporation in Delaware of the Anglo-American Rapid Vehicle Co., with a capital stock of $75,000,000. The gentlemen who are said to be concerned in this flank movement upon the American investing public are a well-known Philadelphia promoter, formerly heavily interested in storage batteries, and one of the original organizers of the Lead Cab Trust, who, having unloaded his Lead stock, now appears as an advocate of the oil motor; two other promoters of the Quaker City not unknown to fame, and two ex-promoters of English fame—E. J. Pennington and H. J. Lawson, both of whom were leading characters in the questionable transactions of the British Motor Syndicate in England several years ago. Mr. Pennington also has an American record, which is open to any who wish to investigate it, and the operations of both these gentlemen in England were followed by such lively developments that an American vacation might be looked for as a natural sequence. For reasons best known to themselves, these two jobbers in second-hand promotions have not allowed their names to be mentioned in the public prints in connection with the Delaware enterprise. A little knowledge is a dangerous thing to affairs of so delicate a nature.

The prospectus of the company announces that the combination owns about 200 patents covering the manufacture of oil motors and vehicles, and that a union of the chief English and American manufacturers of gasoline and kerosene vehicles will be effected, enabling the company to control, etc., in the old familiar siren strain of the stock jobber.

The British contingent of this Anglo-American alliance are the owners of a miscellaneous assortment of motor vehicle patents, some wholly inapplicable to the industry, some worthless, most of nominal value and few only which have been upheld in court and are the basis of profitable industry in England, Germany or France. At most they are mere detail or

construction patents, possessed of no monopolistic value and easily avoided by competent mechanics.

As to the American patents which these promoters lay claim to, no list of them has come under our notice, but no specific enumeration is necessary to warrant the assertion that this part of their stock in trade is of little better quality than the other. There are no American patents which would justify any such capitalization, and none are possible in an industry, which is from the mechanical view merely a combination of old and tried devices and an adaptation of well-known principles to new uses.

Following the methods of the stock manipulator who wishes to impress the unsuspecting with the idea that he has "a good thing," these wily gentlemen announce that none of their $75,000,000 stock is for sale, and that their entire attention for the present will be given to flooding the civilized world with $300 gasoline carriages, for which orders will be booked at once, bicycle and carriage manufacturers in this country having already been placed under contract to turn them out in quantities, etc. These $300 carriages, we presume, are the same ones which many persons in England have been waiting for in vain these two years past, and which have been exhibited, puffed and championed in the English press and nauseam, but have never been sold and seen in actual service to this day.

The price named is ridiculously low. In the present state of the art, no practical and serviceable motor carriage can be built for any such sum, nor is there the slightest danger of a flood of cheap motor vehicles pouring forth upon the world at any price. Promoters are too numerous, and engineers competent in this line as yet too few. Bicycle and carriage manufacturers, even the most enterprising, have much to learn before they can enter upon extensive production in this new branch of industry, and in the manufacture of a new machine like a motor vehicle the distribution of the work on the outside contract system is attended with serious disadvantages. Under these circumstances, therefore, the question of dividends (investors') is one which the promoters would scarcely have the hardihood to discuss and which certainly can have no relation to their scheme. No one who is acquainted with their character and methods will imagine for one moment that they have any intention of manufacturing motor vehicles of any kind further than they think may be required to carry out the stupendous bluff they have undertaken. Manufacturing is not their forte; they prefer to deal in paper. But the season for motor vehicle paper was of short duration; the streets are littered with it, and having been surfeited with water, the public is not likely to drown itself on these gentlemen's invitation.

Dreamers of strange dreams have also seen in their visions of late a ghostly corporation represented by many ciphers, which was said to be all that was left of the motor vehicle, the rubber tire, the bicycle, the carriage, the iron, the steel, the machinist and a number of other industries which had been consolidated into one. The dreamers have been unable to give any more definite description of this flighty visitor, and the ghost will probably trouble us no more. If it appears again it should be caught and gibbeted as a public nuisance likely to frighten women and children. With liquid moonshine suddenly vanished, Lead Cab stocks tumbling about their ears, compressed air a mere mirage, and general distrust and even disgust following as the Nemesis of their early misdeeds, the American motor vehicle promoters in this the final stage of their career have almost ceased to be respectable. They have become grotesque, and if they have any saving sense of humor they will retire and leave the field to the mechanics and the manufacturers, to whom it rightfully belongs.

Damage Suit in Rhode Island.

A damage suit is reported at Providence, R. I. The owner of a steam carriage is being sued by parties who were driving a horse in front of his carriage and were run away with, thrown out and injured by the frightened animal. It is not claimed that the operator of the steam carriage was negligent or that he was driving his machine at excessive speed, the complainants resting their case on the mere fact that the steam carriage is an unaccustomed sight to horses on the highway and has no right there, because of its liability to frighten horses and jeopardize life and property.

The claim will not hold in law, as has often been shown in these columns. The mere fact that a vehicle or machine frightens horses does not banish it from civilization or bar it from the highway. Bicycles, baby carriages, locomotives, road rollers and numerous other things, with which horses must be brought in almost daily contact, cause frequent runaways, yet in these cases the blame is rather attached to the drivers or owners of the horses than to those having charge of the machines, unless a breach of the laws of the road can be proved.

The truth is, we are just beginning to realize what a fractious, unreliable animal the horse is, and if we are to continue to use him on the highway it should be under the express condition that he must be "broken to" these unavoidable sights, among which the motor vehicle is daily becoming more frequent. Even then the animal is treacherous and dangerous, and his gradual elimination from the centers of civilization is not only much to be desired, but is coming to be recognized as a necessity.

Special Notices.

Our Special Notice Department is proving one of the most valuable we have. Advertisers who make use of it almost invariably report satisfactory results. Those who wish to buy or sell second-hand carriages, motors, etc., to negotiate

with inventors, secure situations as engineers or draughtsmen, or who have any special wants in the motor vehicle line, are advised to avail themselves of the facilities afforded by this department. No assurances from the publisher will then be required to convince them that The Horseless Age has a good bona fide circulation among "the right people," as our pleased advertisers often express it.

Accidents, Horse and Horseless.

Statisticians who have undertaken to keep the run of the automobile and horse accidents in France, report that during the month of October there were 906 accidents caused by runaway horses, by which 92 persons lost their lives, while for the same period only 23 accidents occurred to automobiles, from which no deaths resulted, and only two persons were seriously injured. The figures in regard to the relative number of horses and automobiles are not given, but the superior control and safety of the automobile would appear to be demonstrated.

Park Authorities Wavering.

The Central Park Commissioners had a public hearing the other day, at which it was discovered that the only opponents to the admission of motor carriages to the Park are a few old ladies who go pleasure riding, and the hackmen who ply their calling there. Some of the best known horsemen in the city testified in favor of the new vehicle, and as the president of the Park Board so far relented as to take a ride in one, there can be no doubt that the victory is won, and that automobiles will soon be admitted to the parks under reasonable rules.

The Aid of a Great Daily.

Last Sunday's edition of the New York Herald contained a reprint from the Paris edition of two of a series of lectures on motor carriages which are being delivered in the French capital by the well-known chauffeurs and dealers, Charron, Girardot and Voight. The lectures were illustrated by six views of the 6-h.p. Panhand & Levassor carriage and its parts.

The Herald has rendered yeoman's services by the prominence given to the new industry in its news columns for the past few years, as well as by its strenuous advocacy of the rights of users of motor vehicles.

Steam Boiler Number.

We are receiving quite a number of suggestions and new ideas in steam boilers and engines for our special Steam Boiler Number of Dec. 6. Readers who have such ideas and have not communicated with us are requested to do so at once in order to add to the interest of our special number. Steam has a wide field in the motor vehicle industry, and we wish to put most of it under immediate cultivation by sowing the seed of inquiry and investigation.

Several distressing accidents caused by breakage or derangement of the gasoline feed pipes of steam vehicles and consequent sudden bursts of flame from overflowing gasoline, have been reported of late in the public prints. In our Steam Boiler Number we shall treat of this danger and means of preventing it.

Still we hear of broken axles. Notwithstanding a road experience of several years, and repeated proof of the slighting of this most important part of a motor vehicle, inventors continue to build axles too light and of steel of too high carbon for this purpose. A broken axle may mean a broken bone or even a broken neck for the occupants, and to longer incur such risks is to sin against the light. Look well to your axles and shafts, inventors.

It is unfortunate that the name of the Automobile Club of America—a society of encouragement—should have been even inadvertently dragged into the public prints in connection with a ridiculous stock-jobbing scheme like this $200,000,000 myth.

Prospectus of the Sparks Company.

The Sparks Automobile Co., of San Francisco, organized with a capitalization of $1,000,000, is putting on the market 6,000 shares of development stock at $1 per share, par value $10. The proceeds of the sale of this stock are to be used in placing the carriages on the market. The carriage is of the hydro-carbon type, the smallest size, for two persons, using a 4-h.p. engine. The engine for this size has double cylinders; for larger sizes, triple and quadruple. No water jacket is used, the cylinder being cooled by an air blast from a fan. Power is transmitted to all four wheels, the transmission being effected entirely by belts. The construction is very light, embracing tubular frame and axles, the phospor-bronze hubs with either wood or wire wheels, as desired by the customer. The weight of the smallest size carriage complete is claimed to be 400 lbs. It is hoped that this style can be placed on the market at less than $700.

One of the specialties of this company is what they term a compensating, equalizing spring. It consists of a diamond shaped carriage spring of the usual construction, to each end of which is attached a spiral spring. These spiral springs are attached to each other by a turnbuckle, so that the tension may be increased for heavy loads or decreased for light ones. It is proposed to place this spring on the market for use on all kinds of vehicles.

The picture which adorns the front page of the company's prospectus bears a striking resemblance to the electric phaeton of the Woods Motor Vehicle Co.

LONDON NOTES.

London, Nov. 1.

PREPARATIONS FOR EMANCIPATION DAY.

Until "Emancipation Day" things are likely to be very quiet here. Preparations for the run to Brighton on Nov. 13 are well in hand at the Motor Car Club, and already a large number of owners of carriages have signified their intention of joining the run. The following day, the 14th, the Automobile Club will carry through a short run to Richmond, followed by the annual dinner in the evening. It is announced that at the annual cycle shows—the Stanley and the National shows—which both open on Nov. 17, a considerably increased space will be devoted to horseless vehicles.

A MIX-UP IN WALES.

The company which has lately been formed to introduce a public service of horseless vehicles in the Welsh town of Aberdare is meeting with what may be termed a double-barreled form of opposition. On the one hand the Aberdare District Council has for the present refused the application for a license, on the ground that the motor vehicles will throw out of employment the drivers of the horse brakes—old colliers who have been injured. On the other hand, the inhabitants of the town want the public service, but at a meeting this week passed a resolution recommending the Council to provide and run a service of motor vehicles for the benefit of the rate payers.

THE LANCHESTER MOTOR.

With reference to the American Lanchester Motor Co., recently formed in the United States, it is reported here that a company is being promoted in Birmingham to acquire and develop the English rights in the Lanchester carriage. At the Automobile Club's exhibition in June last one of these vehicles was shown in operation and came in for a large amount of commendation on account of its quiet and easy running. None of the mechanism was, however, visible and for some reason or other few if any details have been made public.

A GERMAN MOTOR TRICYCLE.

The Berliner Maschinen Fabrik Gesellschaft (Henschell & Co.), of Charlottenburg, has lately introduced a somewhat novel form of motor tricycle. The machine itself is similar to those already in extensive use in Europe, but in place of the rider being mounted on a saddle he is provided with a spring-suspended and comfortably upholstered seat. The machine is started by the pedals in the usual way, but convenient foot rests are provided for use when once the motor is in operation. The machine can, it is stated, seat two persons, side by side.

The Hiram S. Maxim Automobile Syndicate, Ltd., has been registered with £25,000 capital to promote motor patents of Hiram S. Maxim and J. de Meray.

The French company which is introducing De Dietrich gasoline wagons in the province of Senegal has engaged Chinese motormen, who are now being instructed in the art of managing the machines.

According to the rules which the Automobile Club of France has prepared to govern competition for the Bennett Cup, challenges may be issued by any club recognized by the French Automobile Club, to wit., the clubs of Great Britain, Belgium, Switzerland, Austria and Turin.

The company referred to in my last letter as having been organized to handle the patents of the De Dion & Bouton Co. in England and the Colonies is entitled the De Dion-Bouton British and Colonial Syndicate, Ltd., and has opened offices at 14 Regent St. London, E. C. They are appointing agencies throughout the United Kingdom.

Graphite Gas Engine Cylinder Lubricator.

The high temperatures in the cylinders of gas and gasoline engines render their lubrication difficult. The high pressures formed at the beginning of the stroke render it no easy matter to apply the oil at the point where the best use can be made of it. Graphite, being unaffected by heat, is regarded as the ideal lubricant for such cylinders, and an increasing amount of attention has been given to rendering it available for this purpose. The Lunkenheimer Co., Cincinnati, O., well-known manufacturers of lubricators, have designed and are manufacturing a special "Sight Feed Graphite Lubricator for Gas Engines," which is highly recommended for engines of this class.

The cup is attached directly to the air suction pipe of the engine, as close to the vaporizer as possible. At each suction stroke a current of air is drawn through the passage B, through the cock F and past the sight feed H. The amount used is determined by the relative adjustment of the throttling screw A and the stop cock. When the latter has been turned off it can be accurately brought back to its former adjustment, as it is made to stop against the screw point G.

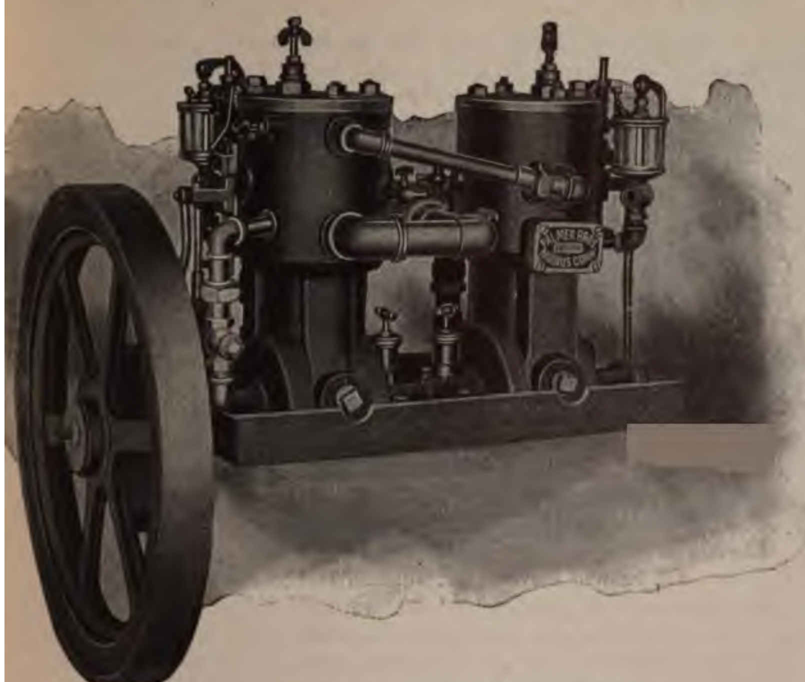
The manufacturers state that they have found that about 1-20 oz. of graphite per horse-power hour for a run of 10 hours will give good results. After the graphite has been forced into the surface of the metal by the movement of the piston, the amount of oil used may be reduced to one-third.

Damage Suit at Providence.

Alonzo T. Cross, Providence, R. I., owner of a steam carriage, is the defendant in two suits for damages, one for $3,000, the other for $5,000.

The plaintiffs are Ella A. Williams and her husband, Walter S. Williams. The wife sues for $3,000 and the husband for $5,000.

They were driving on Messer St. on April 30 last, when, it is alleged, the horse behind which they were riding took fright at the motor carriage that was being operated by Mr. Cross. The animal ran away, the carriage was overturned and the occupants were thrown to the ground, receiving severe injuries, from which they claim they are still suffering.



PALMER TWIN CARRIAGE MOTOR.

Palmer Carriage Motors.

Palmer Bros., of Mianus, Conn., the well-known manufacturers of marine gasoline motors, are placing on the market a twin vertical carriage motor on the same principle as their marine motors—i. e., the two-cycle principle, giving an impulse every revolution.

This new motor gives full 3 b.h.p., weighs 260 lbs., has cylinders 3½ in. in diameter and a stroke also of 3½ in., and is reversible. Water is used to cool the cylinders.

For the purpose of testing these motors and for their own pleasure, they have constructed a carriage and placed one of the motors in it. This carriage weighs about 900 lbs. and carries two or four persons, as desired.

The frame is of angle steel and the tangent wire wheels are 28 and 30 in. in diameter respectively. The motor, located just behind the center, transmits its power by fiber gears and chains, giving two speeds, the intermediate speeds being obtained by control of the engine.

Pivoted hub steering is employed, and there are two brakes, one on the tires, the other on the differential.

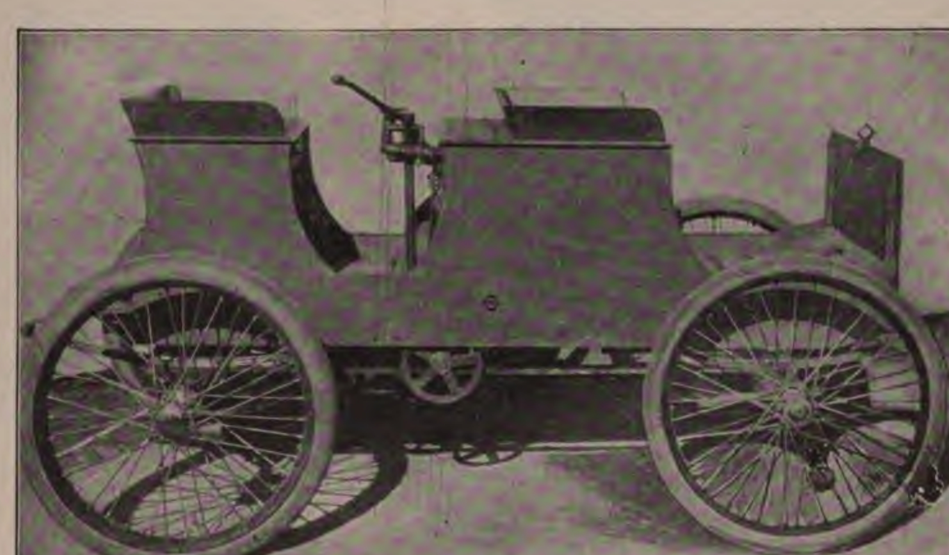
This carriage has ascended the steepest grades in that section of Connecticut, which are said to reach 25 per cent. in some places.

Palmer Bros. will not manufacture carriages, but will sell these motors and parts of them; also steering axles, differentials and other motor carriage parts, to the trade at large.

The Anglo-American Company.

The $75,000,000 company which was reported last week as having been incorporated in Delaware under the name the Anglo-American Rapid Vehicle Co. has a paid in capital of $5,000. The officers are W. W. Gibbs, formerly president of the Electric Storage Battery Co., of Philadelphia, president; F. D. Carley, vice-president, and Clayton E. Platt, secretary. The English end of the scheme is no doubt the Pennington-Lawson combine, controlling a large number of paper patents and a few operative ones on English and Continental motors and vehicles.

The company announces that it will confine itself to oil motors and will not touch electricity. The two English companies mentioned in connection with the deal are the Humber and the British Motor Co., which it is proposed to consolidate with several American concerns. Agencies will be established in all civilized countries, and the vehicles will be made by carriage and bicycle manufacturing concerns, so the president is reported as having said.



GASOLINE MOTOR CARRIAGE OF PALMER BROS., MIANUS, CONN.

International Motor Wheel Co.

The motor wheel, already noticed in our columns, consists of a wooden wheel suitably tired, having a two-cylinder gasoline motor mounted on one side of it. On the other side are two gasoline tanks, that supply the fuel. The motor acts upon the wheel by means of a loosely mounted pinion meshing into a gear upon the wooden wheel. A clutch mechanism, the lever of which is within reach of the driver on the wagon, enables the latter to stop and start the vehicle at will.

No backing device is necessary upon this machine, owing to the fact that it can be revolved upon its horizontal axis; hence, by throwing the wheel about, pointing to the rear, and starting the mechanism, the vehicle will back.

The International Motor Wheel Co., of New York, has been organized under the laws of New Jersey to build these machines. Capt. J. W. Walters, the inventor of the same, is a consulting engineer of many years' practice in designing power machinery.

The company have adopted the policy of appointing agents in all the cities and large towns of the United States, and Canada, who will sell the motor wheels, fit purchasers' vehicles to receive the same and take the vehicles on livery by the month or week, keeping in their employ a trained mechanic to make the necessary adjustments. An important part of the agents' duty will be to instruct drivers of wagons to which the motor wheels have been attached. The cleaning and oiling can be done by an ordinary helper.

The company estimates that by pursuing this policy they will reduce the number of accidents to a minimum and relieve purchasers of all annoyance concerning the mechanical details. The ordinary cost of horse livery in our cities is $20 to $30 a month. These figures their agents will be able to underbid considerably and yet make a profit. This wheel, the makers state, is particularly adapted to business wagons.

We are informed by the company that owing to the great demand for these machines they propose to make contracts with the most reliable machine shops in various parts of the country for the construction of them. The machine is simple and can readily be built in any well equipped machine shop, as it requires no special machinery and but few special tools. The company wish to correspond with firms in this line of business with a view to making contracts at an early date. Their uptown office is at 2158 Broadway, corner Seventy-sixth St., New York, where the wagons and wheels are now stabled.

Hearing Before the Park Board.

Last Thursday the New York Park Commissioners held a public hearing to determine the advisability of admitting automobiles to Central Park. Fifteen advocates and ten opponents of the new vehicle were present.

Lawson N. Fuller, one of the best-known horsemen in the city, said he had driven four, six and eight horses near automobiles without accident, and expressed the opinion that accidents in driving were generally the fault of the driver. Geo. F. Chamberlin, vice-president of the Automobile Club of America, recounted his experience in a recent tour from the White Mountains to New York, described in The Horseless Age. A. L. Riker, Whitney Lyon, Winslow E. Buzby, S. H. Valentine, A. R. Shattuck, A. C. Bostwick and others gave favorable testimony, while the legal status of the automobile was ably defined by ex-Magistrate Simms.

The opposition was represented by a livery stable keeper, a number of private persons who are accustomed to drive in the Park, and an attorney for the hackmen who ply their trade therein.

The decision of the Board was reserved.

METHOD OF APPLYING MOTOR WHEEL.

MINOR MENTION.

Panhard & Levassor are turning out 45 to 50 vehicles a month.

The Marsh Motor Carriage Co., Brockton, Mass., have leased a one-story factory in that town, 150 x 30 ft.

The new electric carriage of the E. C. Stearns Co., Syracuse, N. Y., has been shipped to New York City.

The Ferracute Machine Co., Bridgeton, N. J., are building a 650-ton press for the manufacture of motor vehicles.

It is rumored that a motor carriage is to be established at New London, Conn., by H. S. Owens, a bicycle manufacturer, and others.

C. F. Splitdorf, 21 Vandewater St., New York, has applied for a patent on a jump-spark coil, which weighs 3 lbs. and gives a thick 1-in. spark.

Leon Bollee, the inventor of the three-wheeler with single drive wheel in the rear, is building a four-wheeled vehicle and will discontinue the three-wheeler.

The Illinois Electric Vehicle Transportation Co., capital stock $25,000,000, has been authorized to do business in Illinois with a capital stock of $350,000.

The Buffalo-Rochester Electric Power & Auto Co. is said to have been formed at Rochester, N. Y., to develop and sell automobile patents. The capital stock is $5,000,000.

Newark, N. J., reports a new corporation, the Economical Vehicle, Automobile & Transportation Co., $100,000 capital stock, all paid in by William J. Brewer, New York City.

The committee on law of the Philadelphia City Council are considering the advisability of levying a tax of $10 a year on public motor vehicles. The matter was referred to the City Solicitor.

The American Bicycle Co., the new trust in that line of manufacture, has ordered the factory of the Indiana Bicycle Co., Indianapolis, Ind., set apart for the exclusive production of automobiles.

Arnold A. Samuels, 1120 Eleventh St., Moline, Ill., is the builder of an electric carriage weighing 670 lbs., the source of energy being a battery of dry cells weighing 184 lbs. The motor is of 2½ h.p.

At a meeting of the New England Insurance Exchange, held recently at Boston, Mass., it was recommended that an additional rate of 5 cents per $100 be charged on barns and stables where gasoline vehicles were stored.

Dr. A. W. J. Best, Macon, Ga., has invented an engine which he calls the "frictionless," and which he claims requires but half the boiler power of other engines and only half the fuel. It is specially designed for automobiles.

H. F. Eastman, Cleveland, O., inventor of the three-wheeled electric vehicle illustrated in our issue of July 5, is reported to have interested Detroit capital in its manufacture. Four wheels will be employed, however, instead of three.

The Rubber Goods Co., the syndicate controlling a large number of the rubber tire plants of the country, has absorbed the rubber plants of the Hartford Rubber Works, the Indianapolis Rubber Co. and the Peoria Rubber & Mfg. Co.

For keying gears, sprockets, cranks, etc., to shafts, the Woodruff Patent System, controlled by the Whitney Mfg. Co., Hartford, Conn., is in extensive use. Forty-one different sizes are carried in stock and special sizes are made to order.

The Kensington Bicycle Co., Buffalo, N. Y., are manufacturing a light electric carriage, in which the source of current is a new and patented storage battery, claimed to be light, durable and economical. They also sell the storage batteries separate.

A. M. Herring, St. Joseph, Mich., inventor of the "Mobike" tandem recently illustrated in our columns, is in New York negotiating for the establishment of a factory somewhere in the East to turn out this and his motor bicycle, also illustrated in our columns.

Charles H. Black, Indianapolis, Ind., is reported to have sold his motor vehicle patents for $20,000 to a number of capitalists, who will establish a factory at Shelbyville, same State. Mr. Black had constructed several different types of gasoline vehicles.

The Morse-Keefer Co., Salisbury, Conn., manufacture a full line of swaged nickel steel motor carriage spokes with nipples to fit. The sole selling agents for the United States are the Iven-Brandenburg Co., 56 Reade St., New York, and 131 Lake St., Chicago.

J. Hector Graham, who until recently did business under the name of the Graham Equipment Co., at 170 Summer St., Boston, Mass., has changed the name of the company to the Graham Equipment-Motor Co., with $100,000 capital stock. The old company was threatened with suit.

The Marlboro Automobile and Carriage Co. has been incorporated under Maine laws with a capital stock of $100,000, of which $75 is paid in. O. P. Walker is president, and F. A. Powers treasurer, both of Marlboro, Mass. C. F. Choate, Jr., of Southboro, Mass., is the third incorporator.

The American Xylonite Co. was recently incorporated in Maryland to secure control of wood pulp factories in Indianapolis, Ind., and Latrobe, Pa., and manufacture motor carriage bodies, etc. The incorporators are Leon O. Bailey, Indianapolis; H. F. New, Martin Lauer and H. F. Williams, of Baltimore, and John R. McFetridge, of Philadelphia. The capital stock is $500,000.

Motor Vehicles at the Madison Square Garden.

Motor vehicles will be the feature at the Fifth Annual Cycle and Automotile Show to be held at Madison Square Garden, New York, during the week following Jan. 20. The big amphitheater on the main floor will be divided into 143 spaces exclusively for bicycles and motor vehicles, while there will be 81 additional spaces in the first balcony. Makers of motor carriage parts will also be represented. The manager will be Frank W. Sanger, for many years identified with cycle shows at Madison Square Garden.

Relative Value of Balancing in Gasoline Motors.

By A. M. Herring.

After thorough provision has been made for proper ignition in a gasoline engine and equal care has been taken with the design of the carbureter to cause a proper mixture under severe conditions, such as extreme cold weather, etc., some serious attempt should be made to reduce the vibration produced by the reciprocating pistons and the reverse torque of the explosions. There are many ways in which the primary or mechanical vibrations may be counterbalanced. One is to have two cylinders exactly opposite each other and connected to crank pins 180 deg. apart. Perfect balance by this method necessitates three crank pins, two of which are co-axial and actuated either by a forked connecting rod or by two separate rods from one of the cylinders. The two rods must not only be of the same weight as the one rod from the opposite piston, but they must be exactly similar in the relative position of their centers of gravity. Next, the pistons of the two opposed cylinders should also be of exactly the same weight. An engine so constructed may then be considered as perfectly balanced from a mechanical standpoint. In actual use, after the bearings become slightly loose, one should expect the same results from it, for when the least play becomes apparent at the joints much of the balanced feature disappears in the uneven shocks which enable one piston mechanism to follow the least irregularly after the other.

Approximately balanced engines are often built by placing two opposing cylinders slightly out of direct line with each other. The balance in this case is more nearly perfect, as the cylinder axes more nearly coincide, but the benefit is not entirely lost in placing two cylinders far enough out of direct line for both cylinders to be on the same side of the shaft and operate opposite cranks. Many other methods might be mentioned, such as using two separate shafts geared together so that they rotate in opposite directions and with two connecting rods from each piston—one to each shaft. Such engines in theory are balanced and might be expected to be free from vibrations. In actual use, however, they are often found more unsatisfactory in this respect than the simplest single-cylinder engine, as the noise and shock from loose joints and the smallest backlash in the gears often outweighs any advantage gained from the better theoretical construction.

In a commercial vehicle, freedom from vibration, or at least from disagreeable vibration, is absolutely essential to lasting success, but it must not be overlooked that simplicity and moderate first cost of the mechanism are equally desirable—in fact, there can be but little question of the truth of the maxim that "mechanical balance secured at the expense of doubling the engine parts is too dearly bought to pay in a popular-priced vehicle." Leaving aside the question of first cost and greater complication in the multi-cylinder engine, there are still other points in favor of making the cylinders as few as possible. One is the greater ease of igniting weak charges; another, the fact that charges burnt in large cylinders give considerably higher mean effective pressures than in small ones, so that where ample room is allowed for a large diameter of fly wheel, single-cylinder engines can in the same total weight be made to give considerably more power than would be obtained from a number of small cylinders of equal capacity.

Without adding bob weights, which move back and forth in opposite direction to the piston, or otherwise complicating the moving mechanism, the absolute balancing of a single cylinder engine may be considered as impossible. Nevertheless, it is by no means impossible to reduce the vibration to such an extent that its effects are no longer disagreeable.

Suppose, for an experiment, we place an anvil upon a long plank which is supported at its ends, then by the slightest pressure of the finger at the proper interval we can cause the anvil and board to vibrate in a considerable arc. Should we measure the pressure applied by the finger and the distance it is moved through each stroke, we would find it corresponded to an exceedingly small amount of work—not 1-500 part of what we might instantaneously apply in a hammer blow without visibly disturbing the anvil at all. In fact, the lighter the hammer is in proportion to the anvil and the quicker the stroke the less the disturbance communicated to the plank, which in this instance we may compare to the body of the vehicle. Continuing the comparison further, the anvil will represent the cylinder, the crank case and to a certain extent the fly wheel and that portion of the carriage frame to which the cylinder is rigidly attached. This piston and a part (about two-thirds of the upper length) of the connecting rod represent the hammer. The blow, however, is more sudden than the pressure of the finger, and less quickly applied than that of a hammer blow, but partakes to some extent of the character of both. The slower the speed of the engine the more gradually is the pressure applied and reversed, which, were it not for the much smaller energy to be absorbed and returned at slow speed of the piston, would be most favorable to giving greatest vibration to the upper body and to the passengers. With engines which are balanced around the shaft, except for the reciprocating motion of the piston the vibration communicated to the upper body of a vehicle is generally much more severe at moderate speed than it is at the highest at which an engine may be run. These considerations therefore naturally lead to the adoption of very high-speed engines, in which the crank and fly wheel are perfectly balanced (the lower 30 per cent. of the connecting rod should be considered a part of the crank pin and this should be exactly balanced by equal weights placed on each co-terminus of the crank cheeks), and in which the piston and connecting rod are as light in proportion to the balance of the mechanism as it is possible to make them. For the majority of vehicle engine designs which the writer has examined, the piston and connecting rod weights were from four to twenty times as heavy as absolutely necessary with best commercial material, and as a consequence the vibration of the engines was correspondingly less tolerable. The placing of the engine as well as the weight of its moving parts must not be overlooked in proper vehicle design. If the engine be so placed that the axis of its cylinder passes through the center of gravity of the combined weight of the under body parts, then, if the cylinder be rigidly attached to the under body, the whole of the latter weight is added to the anvil. This result is most easily secured by making the piston motion parallel to the line of motion of the vehicle rather than upright or crosswise. The placing of the engine above or below the center of weight of the under body (wheels included) diminishes the advantages in much greater proportion than the relative displacement.

The vibration due to the recoil from explosion, or the reverse torque, as it may be called, cannot be fully overcome by any mechanical means which do not in complication and cost overweigh much, if not all, of the advantages gained. For slow-speed engines with high compression the disagreeable effects from the recoil of explosion is very great, but the vibration decreases very rapidly with increase of speed—so much so that with well-designed engines running at speeds above 600 revolutions a minute it is no longer objectionble where proper springs are interposed (as they should be in all connections) between the upper and lower body.

COMMUNICATIONS.

Suggestions on Balanced Motors.

Buffalo, N. Y.

Editor Horseless Age:

As there have recently appeared in your periodical several communications in regard to balancing gas engines, the writer would like to "put his foot in it."

The first consideration should be the type of motor. Second, the multiplicity of cylinders, together with their relation to one another, as regards position and time of impulse.

In regard to the type a two-cycle motor, or one in which the explosion takes place every revolution, will give less vibration than the same power at the same revolution in a four-cycle. The writer had occasion to illustrate this in the following manner: In a launch with a vertical two-cycle motor, 3 h.p., running a solid propeller 500 revolutions a minute, a device was arranged on the sparker so that it was possible to run the motor continuously and without changing anything, and make it spark every or every other time, at will.

It will be understood that the arrangement made it possible to run two cycle or four cycle and observe the results. As the load in this case was constant with the revolutions, it will interest some people to know that there were nearly as many revolutions and consequently practically the same power when sparking every other time as when sparking every time. When the motor sparked every time there was no disagreeable vibration, as was experienced when a heavy charge was ignited every other time.

To make the action on a carriage plainer, it is desirable to explain the action in a boat: When a motor turns a propeller in a launch, the resistance of the blades against the water is overcome by the hull turning in the opposite direction, tending to elevate the center of gravity and lower the center of stability of the hull. If the power applied to the shaft is uniform the hull will careen sufficient to balance it. If the power is intermittent there will be a tendency for the hull to settle back between impulses, resulting in a jerking back and forth, the interval between the impulses and their magnitude determining the amount of the jerk.

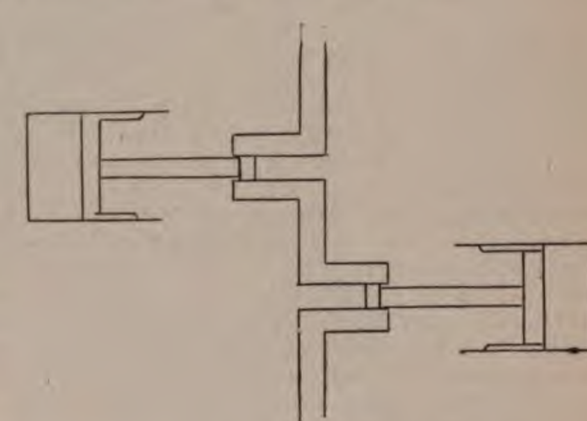
From the above it may be inferred that two motors of 3 h.p. give less vibration than a single one of 6 h.p., from the fact that the period between impulses is half as long and only half the magnitude. Then if the fly wheel should be made heavy for one case, it could be lighter in the other, except that in starting a load it is desirable to have a heavier wheel.

If it has been determined to use a twin two-cycle motor the cylinders should be placed side by side, with the cranks opposite, which will bring the explosions equally distant apart and put the running parts in stationary balance, but not in rotary balance—i. e., rotating in the same plane. If the two cylinders were placed opposite each other with cranks opposite (see sketch), the parts would be nearly in rotary balance. If the explosions were timed to take place simultaneously in each cylinder, driving the two pistons toward each other, the line of explosions would neutralize one another, but rotary impulse would be twice as great as in the former arrangement, resulting in more vibration.

If two four-cycle motors are used they should be placed with cylinders and cranks opposite. This arrangement will bring the explosions equally distant apart and the running parts nearly in rotary balance.

If the cylinders are side by side, the cranks would have to be together in order to have the explosions come equally apart. This would make the vibration excessive because of the arrangement of the cranks.

Four cylinders of each type taken as pairs should have the same consideration. Three cylinders of the two cycle could be placed side by side, while three of the four cycle should be placed at an angle of 120 deg. Three cylinders could not be put into rotary balance so well as two or four.



A general review of the foregoing leads to the conclusion that it is the force of the explosion, tending to drive the resisting parts ahead, that must be overcome, and the solution seems to be in a number of small impulses at frequent intervals.

Single motors of 6 h.p. will lift the forward end of a carriage up and down in starting or hill climbing, and the vibration is still more marked when the number of revolutions corresponds with the time of vibation of the body on the springs. Even in the small De Dion tricycle it is quite perceptible to the rider at the start. The extra battery power necessary and the multiplicity of parts will, in the writer's opinion, limit the number of cylinders to two on all successful carriages.

As a good sparker is the principal part of a motor, the writer would like to express his opinion upon that later. Yours truly,

W. S. HOWARD.

Weight and Traction.

Brooklyn, Nov. 5.

Editor Horseless Age:

In your current issue Mr. F. C. Tygard says that he thinks more weight should be put in motor vehicles. In this I beg to disagree with him. I believe the majority of vehicles are about on a par with the bicycle of 1890. There are a few light ones on the market which will probably be hard to improve on for weight. Some of them exhibit gross mechanical ignorance, which might account for many breakdowns—in fact, it surprises me that they are not more frequent.

It should be borne in mind that if we add a certain per cent. of weight to all parts for the purpose of extra strength, we have added approximately the same per cent. of load to be carried. In that case have we added to our factor of safety? The size of the motor will have to be increased with the rest, as it has so much additional work to do. The weight of the

so-called paying load of course is unchanged, but that is only a small proportion of the total load.

A 25-lb. bicycle will carry a 200-lb. man. That is eight times its own weight. An ordinary buggy will carry about twice its weight. The battery and motor of an electric carriage weigh about 1,000 lbs. Why does it require another 1,000 lbs. to carry that? What we must do is to trim all we can. The lighter we make one part the smaller we can the remaining parts, which in turn allow us to again lighten the first piece, and so on ad lib. until we get to a point where the paying load "cuts a figure." No material or workmanship should be considered too good. If we can cut the weight of a vehicle in two, it means a large saving in cost, even if the materials are more expensive. It also means a large saving in the cost of running and wear and tear, especially on tires, which on a heavy vehicle have a far greater depreciation factor than the storage battery.

Mr. A. M. Herring in the same issue of The Horseless Age gives some very timely advice on the subject.

Mr. Tygard appears to be under the common but erroneous opinion that weight is necessary for hill climbing in order to obtain traction, apparently confounding the case with a locomotive, which has to pull a load. When the weight is all on the propelling vehicle there is nothing gained by adding weight, as it simply adds to the required traction proportionately to the amount gained.

HARRY E. DEY.

This American Company Employs Aluminum.

New York, Nov. 3.

Editor Horseless Age:

We notice in your issue of Oct. 25 that you mention that American carriage builders have paid little attention to the lightening of motor vehicles by the use of aluminum. We beg to state that we have done much costly experimenting in this line for about five years, and have adopted the use of aluminum in such parts where the peculiarities of the metal are well suited. It is a very difficult matter to determine where to draw the line, but in our present automobiles we certainly save between 100 and 200 pounds by the use of this metal.

Yours truly,
AMERICAN MOTOR CO.
Albert T. Otto, President.

QUESTIONS AND ANSWERS.

At the request of many of our readers we have decided to open a department of questions and answers. We will endeavor to answer any detail question in practical engineering pertaining to motor vehicles.

How Large a Pipe for this Muffler.

Baltimore, Md., Oct. 23.

Editor Horseless Age:

I notice in the June issue of The Horseless Age, on page 14, an account of an explosive motor exhaust muffler by Mr. Tygard. I have a gasoline carriage and would like to make it lighter by taking off the exhaust pot and adding the muffler described by Mr. Tygard. The exhaust pipe is 1¼ in. and I would like to know what size pipe to add to the exhaust to muffle the sound.

JAMES A. CALLOW.

We remember the device described by Mr. Tygard being applied to a steam engine a number of years ago and do not doubt it may be used on the carriage in question. It would be well, however, to communicate with the builders prior to making any expensive experiments.

In this connection please note reply to a query on same subject on page 11, No. 4, of present volume.

R. I. C.

Time of Spark.

Westfield, Mass., Oct. 17.

Editor Horseless Age:

Kindly give me through your valued paper some information as to where the piston should be on its stroke to get the greatest power when the spark is made. Very respectfully,

GILBERT J. LOOMIS.

Usually the object is attained in practice by having the explosion take place at the dead center; the spark being given in advance of this stage, the amount of advance being known as lead. This is best determined by the use of the indicator.

R. I. C.

Explosion at Both Ends of Piston.

Dallas, Tex., Oct. 25.

Editor Horseless Age:

A subscriber wishes to ask whether there is any practical gasoline or gas engine on the market which has explosions on both ends of the piston. I have never seen them advertised and have wanted to know whether they have been tried. It seems to me to be very possible to accomplish this successfully and perhaps you can enlighten me as to why it has not been done before.

G. H. G.

We do not know of any gas or gasoline engine of the double action mentioned. The difficulty is a matter of temperature, and if our friend can devise a manner or method of packing piston rod glands to withstand the extreme heat in a practical and satisfactory way he will greatly advance the present state of the art.

R. I. C.

Deduce for Yourself.

Jersey City, N. J., Oct. 21.

Editor Horseless Age:

Will you be so good as to let me know the following:

1. About what horse-power should the motor be for a one-seated wagon to carry two people?
2. Voltage and amperes of batteries used?
3. How many revolutions of motor to one of wheel?

A. B.

Descriptions of light electric carriages embodying the gist of the information sought may be found in The Horseless Age, Vol. 4, Nos. 17-23, etc.

R. I. C.

CANELLO-DURKOPP GASOLINE CARRIAGE.

The Canello-Durkopp Gasoline Carriage.

A gasoline carriage which is attracting no little attention in France is the Canello-Durkopp, made at Courbevoie, near Paris. The manufacturers have furnished us with material for a complete description, which we append.

The motor, of 4, 6 or 8 h.p., is composed of two vertical cylinders, with hot tube ignition. On the carriage it is placed in front and is concealed from view by a sheet iron case, as in the Panhard & Levassor carriage. Water for cooling is circulated by the thermo-siphon when the power is low and also by a pump controlled by a friction on the fly wheel or by a gear on the regulating shaft.

The inlet valves are automatic, as usual, and the exhaust valves are raised by a cam shaft located in the case H (Fig. 1) and controlled by reduction gears J. Fig. 2 shows how the connecting rods are balanced by a counterweight, Z, attached to the motor shaft I, which on the left end has the starting gear 4 and on the right the fly wheel F, hollowed out to receive the friction pulley, by which the motor is disconnected.

The method of controlling the valves by cams and the governor are represented in Figs. 4 and 5. M is the motor pinion engaging with L, attached to the cam shaft A. This shaft slides in the bearings E E', which are fastened to the shaft by means of the keys R, allowing it to slide in these bearings, but forcing it when it turns to carry with it the bearings P, movable in the bearings O, the latter being fixed to special supports. The pinion M is of sufficient size so that whatever the displacements of the shaft A it never fails to engage with L.

It will be seen that the shaft A carries the cams B and B', provided with bossages, b and b', of eccentric form, which act upon the friction pulleys C and C', attached to the rods D and D', which control the exhaust valves.

The position represented in Fig. 4 corresponds to the moment when C, being in full contact with the bossage b, the corresponding valve is wide open, and the corresponding valve, controlled by D', is closed.

A centrifugal ball governor turns with the shaft A. If the motor races the centrifugal force, overcoming the power of the springs I', will throw out the balls I. A force will then be exerted upon the collar K tending to move the shaft A backward enough to bring the bossages b b' out of contact with the friction rollers C C'. Consequently the rods D and D' are no longer raised at each revolution of the shaft A, and the corresponding valves remaining closed, the motor will slow down until the spring I', acting upon the governor and upon the shaft A, brings the latter to its former position—i. e., brings the eccentric bossages b b' back into play with the pulleys C C'.

In order to exceed the fixed maximum speed in certain cases the operator is able by means of the rod H controlling the bell crank G G, which acts upon a fork in the grooved collar F F', to force the shaft A into the normal position.

As has been said, the motor is located in front. It is so placed that the motor shaft and the fly wheel are in the longitudinal axis of the vehicle. The burners are at M; at I J are the gears and the starting lever; at H the regulating gear; at K the carbureter (Fig. 6). When the gear is thrown in the

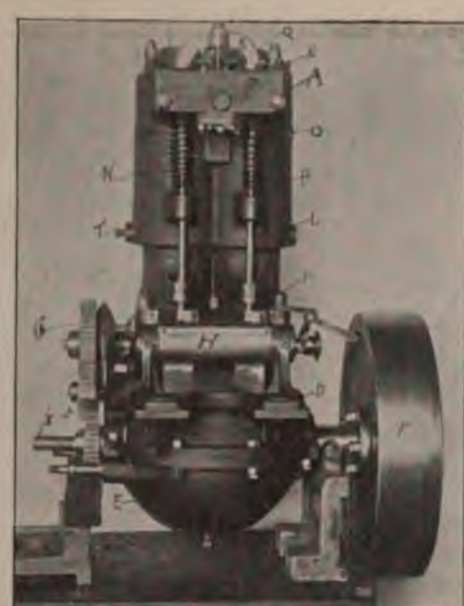


FIG. 1. CANELLO-DURKOPP MOTOR.

shaft enters the case C containing the speed-changing gears. D is the case holding the differential upon the countershaft commanding the drive wheels by pinions and chains.

At G is the water tank, holding 30 liters; the gasoline tank, having a capacity of 22 liters, is in front.

L is the centrifugal pump for the circulation of the water.

E is the muffler. Above at F is the radiator.

These vehicles are generally provided with three brakes—a band brake, 12 (Fig. 5), upon the differential shaft, controlled

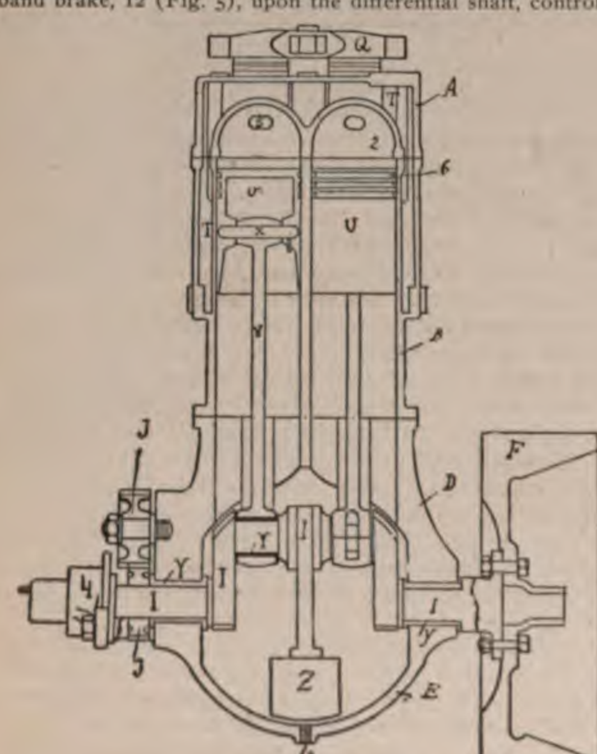


FIG. 2. PLAN OF MOTOR.

by the pedal 26; a band brake, 13, on the drive wheels, controlled by the lever 15, and the shoe brakes 17, controlled by the lever 16. The two first disconnect the motor before they act.

The mechanism employed in the change of speed is well illustrated in Figs. 6 and 7. In Fig. 7 N is the motor shaft extending from the fly wheel, which may be imagined at the left. Upon this shaft are the gears G H, I J and J X. Upon a parallel shaft, A, situated above N and in the same plane, are the corresponding idle gears, engaging with those below of the same denomination, so that H gives the first speed, I the second, J the third and J X the fourth. It will be noticed that G does not engage with the pinion G H, but is commanded by an intermediate pinion not represented in the illustration, which gives the reverse speed. All the lower gears being fastened upon N, the motor then brings into play simultaneously all the

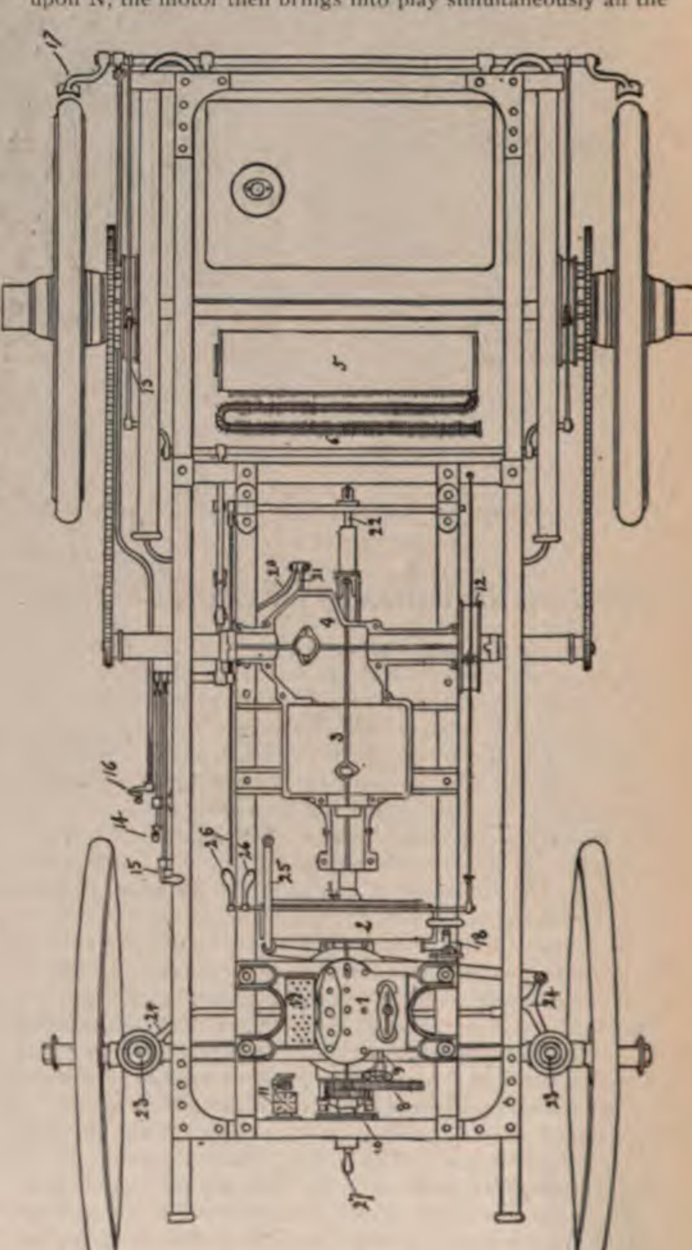


FIG. 5. PLAN OF 6 H. P. CARRIAGE.

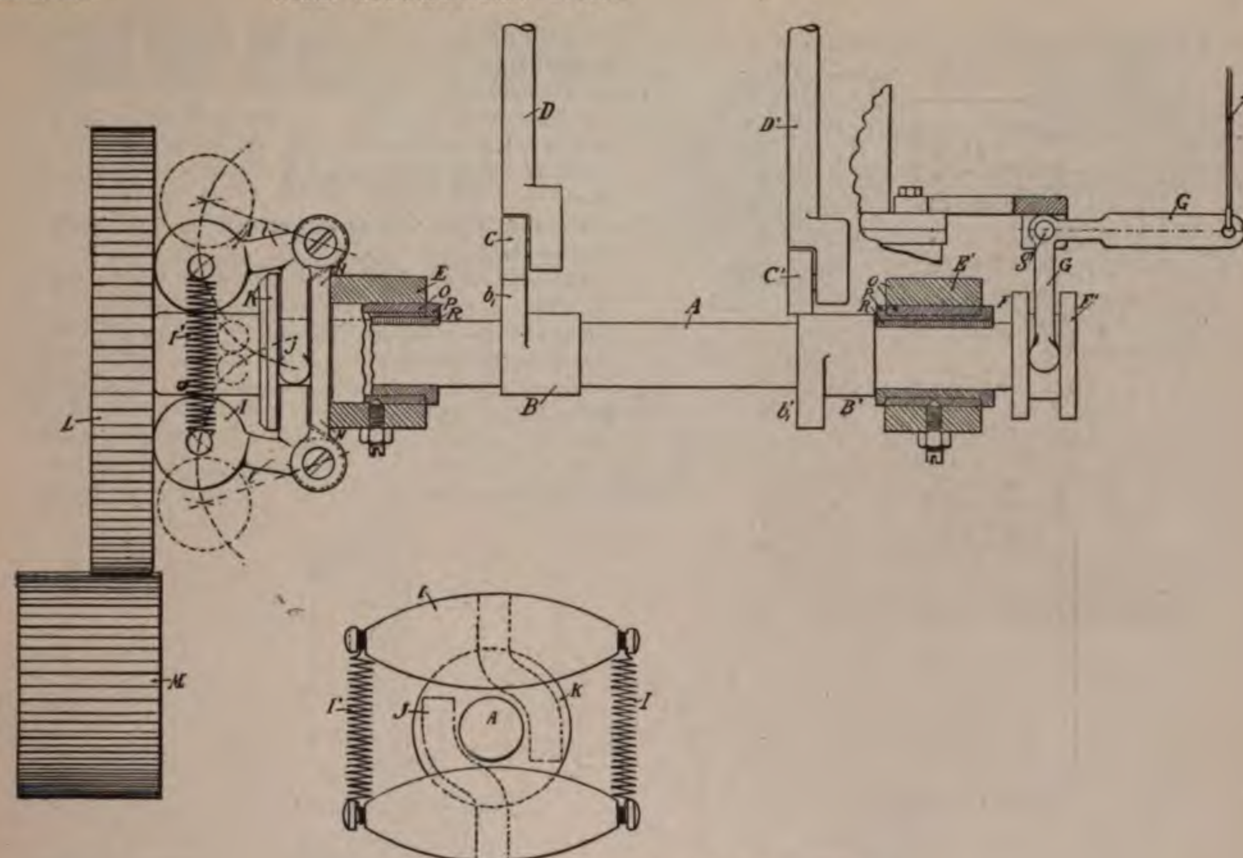


FIG. 4. METHOD OF GOVERNING BY THE EXHAUST.

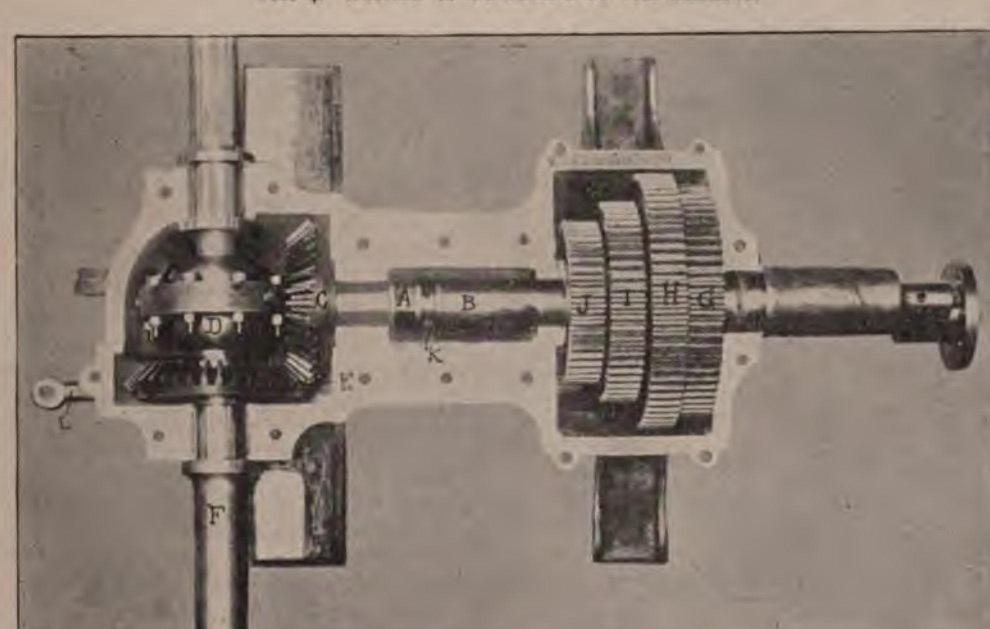


FIG. 6. TRANSMISSION MECHANISM.

upper gears, idle on the shaft A. The gears are therefore constantly in mesh. They turn in an oil bath in a hermetically tight case.

In order that the shaft A may drive the vehicle at a given speed, it is sufficient to make one of the upper row of gears solid with the shaft A. This is done by the inner eccentric joined with the sleeve B, which moves along the shaft A by means of the fork, which moves the collar, K, this fork being controlled by the speed-changing lever (14 in Fig. 5). If then by means of this lever, operating the sleeve B,

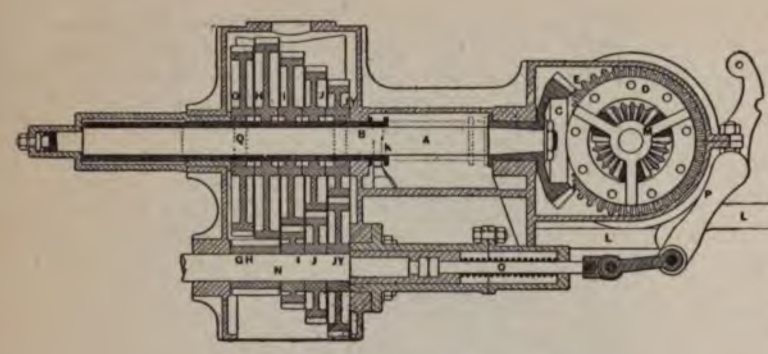


FIG. 7. PLAN OF TRANSMISSION.

we make the gear G solid on A, the pinion G H will set G in motion through the intermediate pinion (not represented), and we will have the reverse.

If the eccentric comes to the right of H the pinion G H will set in motion the pinion H, with which it is always in engagement, H will turn A and we will obtain the first speed, and so on.

The speeds are 5, 9, 12 and 21 miles an hour, with a slow reverse speed.

The shaft A terminates in the pinion C of the differential D, which is midway of the countershaft carrying the chain pinions (Figs. 5 and 6). Moreover, P is an arm, with lever operating the rod O, which draws the shaft N away from the fly wheel and thus disconnects the motor. P is operated by the pedal and brake levers.

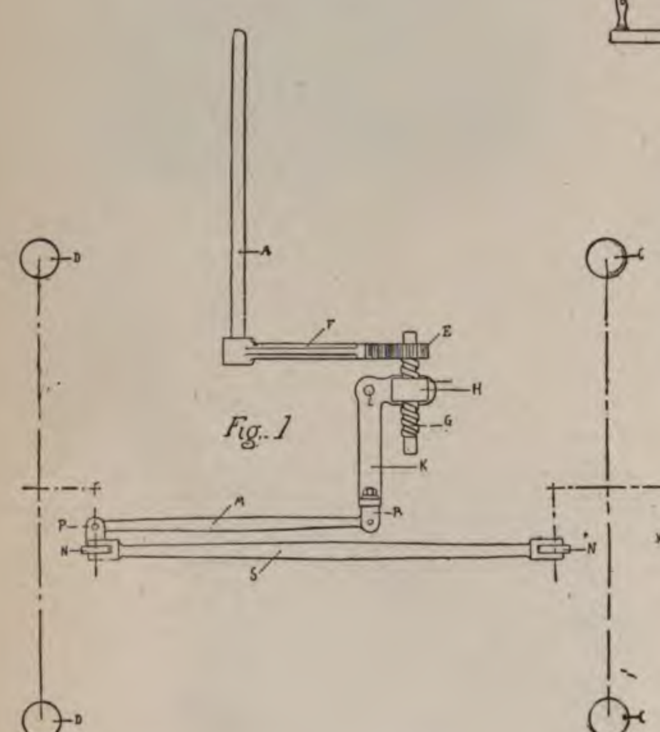


Fig. 1

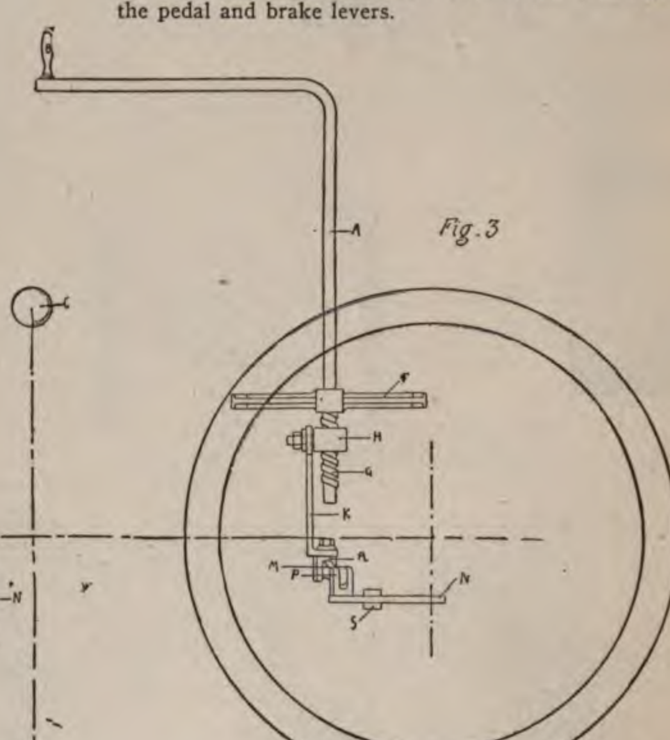


Fig. 3

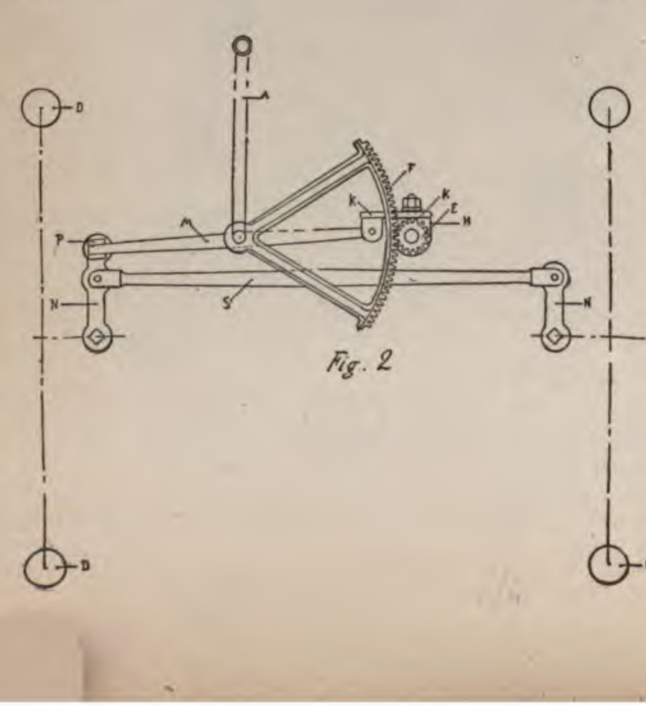


Fig. 2

The most interesting part of the Canello-Durkopp carriage is the steering mechanism (Fig. 8). The front wheels are pivoted, as usual, and are controlled by a lever, but with the interposition of a screw whose object is to relieve the rod of the shocks caused by the inequalities of the road.

The rod A, with its handle B, commands the sector F, gearing with the pinion E, forming part of the screw G. Along G rises and falls the nut H carrying the lever K, attached by the arm M to the steering head N, commanding the front wheels. The joints P and R, at the extremities of the arm M, are flexible, relieving the shocks of the wheels. If one of the wheels encounters an obstacle, the screw G prevents the lever K from communicating the shock to the steering handle. The pinion E will rise and fall in the teeth of the sector F, but will not unmesh. For the same reason the wheels will never deviate so much that the rod will not displace the sector F. The steering handle can therefore be released from the hand without fear of accident. A wheel may be substituted for the lever if desired.

The two most original and valuable features, it will be seen, are the method of governing the motor by the exhaust valves and the steering mechanism.

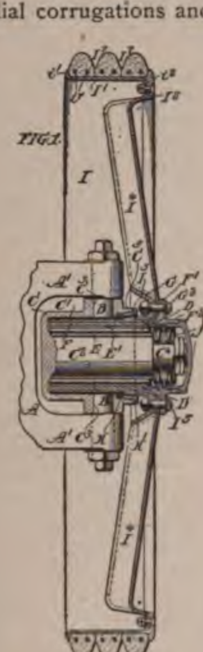
MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 636,012—Oct. 31, 1899—Wheel and Axle.—Geo. S. Strong, New York, N. Y., assignor to John P. Murphy, Philadelphia.

The inventor designs to form his wheel from a single sheet of steel by stamping operations in dies, first forming the tread by flanging, at the same time perforating the center, second stamping radial corrugations and forcing up the hub,



and lastly by a trimming cutter lightening the weight by paring away flat portions. The axle and wheel are clearly shown in the figure.

A indicates the supporting bar or axle proper of the vehicle, which at each end is forked into two branches A' and A', one situated above the other.

B B are journal pins extending through the forks A' opposite to each other, as shown in Fig. 1.

C' is a cylindrical box formed with a closed end C, from the center of which extends a stud axle, C^2, the box forming an annular chamber around this stud axle and being formed with journals C^3 C^3 at top and bottom, adapted to receive the journal pins B B, upon which the box is pivoted.

C^4 indicates a cylindrical projection from the end of the stud axle, upon which is secured a thrust box (indicated at J), held in place by means of nuts, as shown.

C^5 indicates an internally threaded projection at the end of the box C'.

E is a bearing cylinder fitted on the stud axle C^2 and formed, preferably, of hard steel. E' is a similar bearing cylinder, and D D, etc., indicate rollers situated between the two bearing cylinders and forming roller bearings between the wheel and stud axle. The bearing cylinder E' is fitted within the cylindrical hub section F, formed with an outwardly projecting and internally curved flange, F', as shown in Fig. 1. This hub section, continuing beyond the flange, forms the internally threaded cylinder F^2, into which the cap plate of the hub screws, as shown in Fig. 1. G is a second cylindrical hub section adapted to fit in the box C' and fitting nicely over the cylindrical part of the hub section F. The outer end of the hub section G, however, forms an outwardly extending curved flange adapted to fit against the hub section of the wheel, to be hereinafter described, and to clamp it against the flange F' of the inner hub section, bolts G^2 serving to bind the parts together.

H is a packing ring placed in a shouldered portion of the outer end of the box C' and held in place by a clamping ring, H', screwing into the threaded portion C^5 of the box.

Two of the more comprehensive claims follow:

A wheel having an inwardly extending hub connected with its rim by outwardly angling spokes in combination with a box, C', extending over the hub and beneath the rim of the wheel, said box having means for pivotally connecting it with a vehicle frame on a line passing through the rim and hub of the wheel, and a stud axle having its inner end situated in and secured to the box C', all substantially as described and so that the stud axle and whel will turn on a line passing through the tread of the wheel.

A stud axle, C^2, having its inner end secured to and surrounded by a box, C', said box having means for pivotally connecting it with a vehicle frame as described and so that the stud axle will turn on a center passing through its journal portion in combination with a hub, F, adapted to lie within box C' and having a flange, F', and an integral sheet metal wheel body having a tread, I', a downward and inwardly turned fold, I^2, connected with a hub flange, I^5, by U-shaped spokes angling outwardly to said hub flange, and means for connecting the hub flange I^5 with the flange F' of the hub F.

Six claims. Application filed Dec. 8, 1898.

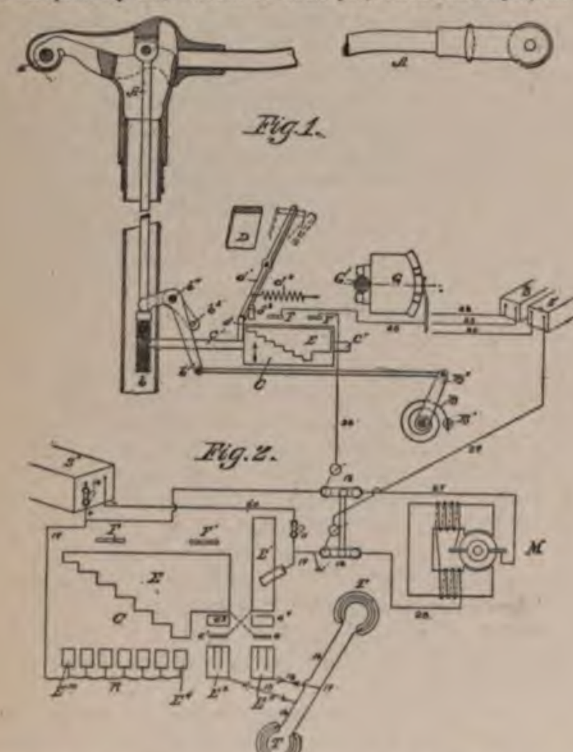
No. 635,816. Oct. 31, 1899—E. A. Sperry, Cleveland, Ohio, assignor to the Cleveland Machine Screw Co., of same place. System and apparatus for controlling vehicles.

Fig. 1 is a diagrammatic view of one of the portions of the control, showing also diagram of circuits. Fig. 2 is a diagram of the circuit connections of the electrical brake, showing certain controller contacts.

In directible road vehicles there is one handle, lever or the equivalent which must be at all times under the direct control, if not directly in the grasp, of the driver. This is the steering handle, and it is desirable that this one handle should do as much of the total work of driving the vehicle and perform as many functions in this connection as possible. In former applications and patents I have shown how a single controller handle may be made to perform a number of different functions in connection with operation of electrical cars and vehicles, and in the present application it will be noticed that the work required of the controlling handle is reduced to a minimum, being virtually that of making and breaking the electric circuit which controls the flow of energy to the motor, thus limiting to a very large degree its necessary range of movement, especially when compared with other arrangements of control, where I have caused it to perform not only the above functions, but others along the line of speed control. This latter function, in the present case, I prefer to perform by automatic means—for instance, by

means of a power motor, which may be of any suitable kind—for instance, a spring—which in this case may be energized by any of the movements of the manipulating levers—for instance, the one by means of which the current is turned on and off after the automatic manipulator has set the device for a certain predetermined speed or combination of speeds.

Any source of electrical supply may be used—as, for instance, the storage batteries S and S', in which case it is preferable to have a plurality of separate generating-units, which may be coupled in various combinations with the motor or other driving element, or the speed or current controlling devices may be of such a nature as to require the batteries constantly coupled as a single unit. A preferred form, however, is the use of two or four generators or groups, which are coupled by the switch in multiple, series multiple, and in

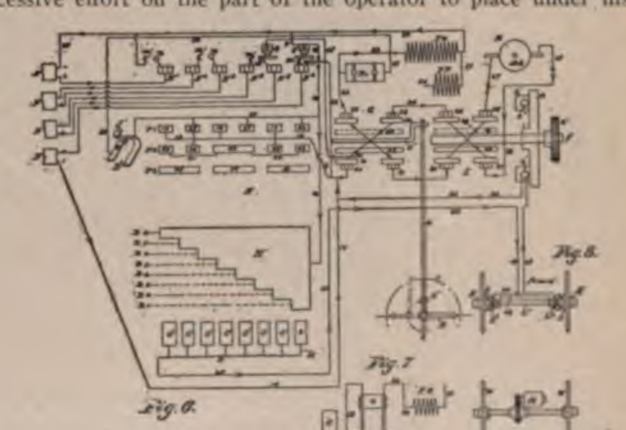


series for effecting the various speeds of the motor. The circuits from the generator S S' will be seen to be connected to the current-graduating switch G, which will be seen to be in series circuit relation with the make-and-break contacts F and F', which in this case both contact with the single conductor E, whereupon the circuit is established through any translating device—for instance, the motor M. The current-graduating devices, being automatically actuated, as described, and the make-and-break switch, being actuated by the controller handle A, are also fully pointed out. It will now be seen that when all the resistance R is eliminated the circuit would be from the positive of the generator or generators, wire 14, contact E^{10}, controller contact E, brush E^{3}, wire 15, wire 16, brake magnets TT, wire 17 18, contact E'', contact E', wire 19, wire 20 or 21, back to the generator or generators, as will be seen. The current direction through the brake magnets in this instance is shown by the arrow heads in full lines. Upon removal of the brake from circuit, however, when the brushes E'' and E^{8} reach the moving contacts e'' and e^{8} the friction will cause them to move away from contacts E and E' and be brought into contact with the moving brushes e and e', whereupon their polarity will be reversed, sending the current through the brake magnets in direction of the dotted arrows, which causes an instantaneous reversal of magnetism, instantly throwing the brake shoes away from the mass, which they grasp or retard, as in the maner well understood. It will again be apparent that at this point all or nearly all of the resistance R has been reinserted in the circuit and the current thereby reduced to a predetermined value. The current between the generators S and S' and the current-graduating switch G passes upon the wires 22 23 24 and to the make-and-break switch by wire 25, thence to the motor by wire 26, switch 13 and 27, returning by wire 28, switch 12, and wire 29. It will thus be seen that duplicate brakes L L and T T are furnished, which are interlocked, and when either one is in action the controller cylinder C of the make-and-break switch will be locked out of action for power, but not out of action for the application of the brake, so that either or both brakes may be applied, and when so applied the motor cannot be operated for power.

Fourteen claims. Application filed Sept. 17, 1898.

No. 635,815. Oct. 31, 1899—Elmer A. Sperry, Cleveland, Ohio, assignor to Cleveland Machine Screw Co., of same place. System and apparatus for controlling electric vehicles.

The invention has for its object to combine, in a single operating system for vehicles, starting, varying the speed, and instantaneously stopping with the least possible inconvenience to the operator and without calling forth at any time an excessive effort on the part of the operator to place under his



control power brakes far more powerful than mechanical brakes, and at the same time applying the brakes to all the wheels of the vehicle simultaneously instead of only to the driving wheels, as heretofore.

The mechanical structure of the circuit-changing apparatus, elevation of which is shown in Figs. 9 and 10, will readily be understood from the figures. The contacts, numbered 53, 22, 54 and 70, are supported so as to move with the shaft d' by intermediate non-conducting material, shown in the present drawings as being in form of a block d''. Co-operating with these contacts are stationary contacts 23 and 31, these two only being seen in the elevation. The four contacts co-operating with the combined charging and reversing switch G are secured to any suitable support—for instance, that shown at G'.

Turning to the system of control or arrangement of electrical circuits of the vehicle, as shown in diagram in Fig. 6, it will be seen that the electricity is generated by separate units

NNNN, each of which may represent a group of generators, the positive and negative terminals of which are coupled, as shown, to the various circuit-manipulating devices. Their function and relation remain now to be pointed out in detail. To the right is observed the gear or segment e', by means of which the controller shaft f is manipulated. On this shaft is mounted the reversing switch I and the controller H, the controller having two active positions—one either side of the "off" position or position of rest (shown in Fig. 10), the latter having eleven active positions, three on the power side (indicated by P' P^2 P^3), and B' to B^8, as will be readily seen, indicating the brake positions. The brushes co-operating with these various contacts are illustrated by N' to N^6, respectively, and those co-operating with the contacts B' to B^8 are represented by O and O' O', etc. These are suitably connected to the resistance R, as indicated. The reversing switch G is seen mounted upon its shaft d' and operated by the crank and links b from the crank pin C' and pointer D. On the two reversing switches I and G these contacts are shown with their electrical connections. Leading from the reversing switch G and also the controller H are flexible wires (indicated by the waving lines), which are numbered in the following description: When the controller is so turned that the brushes N' engage the row P' of contacts, it will be seen that the current flows through the motor in direction of the arrows as follows: coming from each of the generators N it reaches brush N', contact 14, wire 15, brush N^2, contact 16, wire 15, brush N^3, contact 17, wire 15, flexible wire 18, and from the last generator by wire 19 to brush 20.

In Fig. 7 the auxiliary field FR is shown in detail with its connections free from the lines of Fig. 6 for sake of clearness. Connected with each of the brushes N' to N^6 will be found a pair of convex-concave contacts (indicated in Fig. 6 by m'). The changeable, preferably non-reversible, contact n may be connected with any pair of these contacts m and m', representing any one of the different generators N, which, as will be seen, will furnish current to the auxiliary field FR and other translating devices when the controller H is turned in the reverse direction or in any one of the brake positions from B' to B^8. This contact in its engaged position is not shown in Fig. 6, for the sake of clearness, but is clearly indicated in Fig. 7, together with the field connection. Supposing now that the controller is turned in this direction and that the brush O is in contact with the traveling segment H', and again supposing the changeable contact n to be in connection with the crescent seen near N^6, the current will then flow from last generator N, wire 19, wire 55, contact m, co-operating contact n, wire 56, auxiliary field FR, wire 57, wire 34, wire 35, brake contact H', brush O, wire 58, removable contact n, crescent m', brush N^6, back to negative of the last generator, as will be readily understood. Another purpose of the removable contact is that of changing at will of the operator from one to the other of the generators, so that all may be exhausted similarly, and its further use may be indicated by the fact that through the wire 66, which will be seen as being derived from wire 19 above traced, will be furnished energy on this derived circuit for the normal magnetic brake system, principally for the purpose of that as soon as retardation of motion is commenced, the mass, the center of gravity of which is usually high above the ground, pitches forward, bringing a large mass of the weight over and upon the forward wheels, removing a corresponding amount from the back wheels, and it will be seen that, during the time of braking, the forward wheels bearing, as they do, a materially increased amount of the load, are the most important factors in stopping and their retardation will tend to bring the mass to rest quicker than an equal amount of retardation brought to bear upon the rear wheels.

Suppose now the generators N are storage batteries which require storing at intervals. I have provided a special means for this purpose, which will be found to eliminate the difficulties heretofore experienced where the controller is required to be placed in the series position prior to charging, which is almost universally the case, and where if the motor circuits are not opened by some means outside of the ordinary controllers the carriage tends to suddenly start or run away. This trouble I overcome by providing charging terminals S and S', the former being connected by wire 68 to a special contact 70, located between the running contacts 21 and 53 on the reversing switch G. (See also Fig. 9.) The direction of the current with the controller turned in position P^3 will then be as follows: The current entering the positive post S proceeds by wire 68 to terminal 70, brush 20, wire 19, to the last generator, brush N^6, terminal 50, brush N^5, to third generator, brush N^4, contact 49, brush N^3, to second generator, brush N^2, contact 48, brush N', to first generator, wire 34, wire 71, to the negative charging terminal S', it being understood that a reversing switch handle D is previously placed in the upright or middle position, as shown in Fig. 9, whereby the contact 70 and brush 20 are brought together. When in this position, it will readily be seen from this view, Fig. 3, that all of the other brushes—viz., 23, 31, and 32—are open-circuited, and in this way the motor is effectually out of circuit whenever the charging operation goes forward, and when the motor is in circuit the positive charging binding post S is necessarily out of circuit.

The two claims attached are fairly descriptive of the system in general.

In an electric system, a dynamo electric machine used to generate currents periodically, a controller for the circuits of such machine, a set of contacts on the controller, connected with the field coil of the machine, and an electric battery also connected to such last-named set for fixing the residual magnetism of the field of the machine, before starting upon the generating periods.

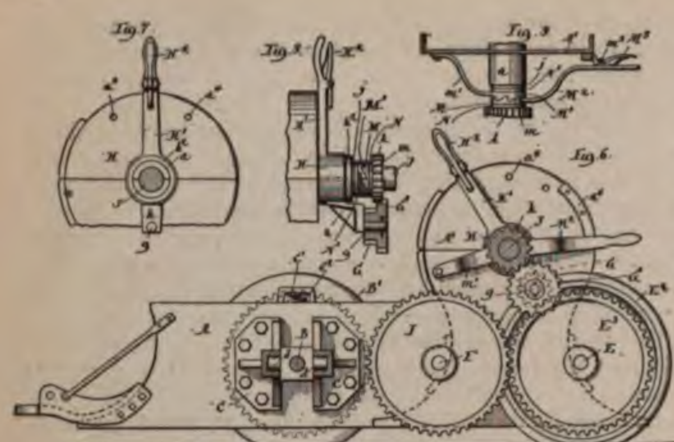
In a system of control for electric vehicles, a controller having two operative positions separated by an "off" position, a plurality of electric generating units, an electric motor upon the vehicle, connections with the controller for coupling the generators in multiple and in series to the said motor for varying the power when at one side of said "off" position and means for reversing the elements of the motor and closing the circuit through a variable resistance and electric friction brake, when on the other side.

Forty-five claims. Application filed Sept. 6, 1898.

No. 636,948. Oct. 31, 1899—Ernst H. Korsmeyer, Higginsville, Mo., assignor of one-half to Fritz Langkrahr, of same place. Motor vehicle.

The inventor proposes providing an effective and simple locomotive propelled by an explosive engine in the following manner. Fig. 6 is a side elevation, parts in vertical section and engine removed. Fig. 7 is a detail view showing the operating lever, and means for locking, and part of the main frame. Fig. 8 is a detail view in rear elevation of lever mechanism on main crank shaft. Fig. 9 is a plan view showing hand starting lever and the grip lever.

From the construction of parts it will be seen that when the hand lever H' is in position shown in Fig. 6 of the drawings



the pinion G will be in engagement with the gear wheel E' on the rear axle, and this will be the position of the pinion when the locomotive is to be driven in backward direction. If it is desired to reverse the direction of travel of the locomotive, the hand lever H' will be shifted rearwardly from the position shown in Fig. 6 until the pinion G engages with the gear wheel F, and the hand lever H' will be held in either position to which it may be turned by means of the grip lever H². Manifestly when the hand lever H' is shifted to the central position (seen in Fig. 7) the pinion G will be disconnected from both the gear wheels F and E², and will therefore not permit rotation to the driving wheels of the locomotive.

Between the hub k of the clutch member or wheel K and the flange j of the main crank shaft J are placed the rings M and M', the abutting faces of these rings or collars being formed with inclined surfaces or teeth m, as clearly shown in Fig. 8 of the drawings. Preferably a ring N will be interposed between the ring M and the hub k, and a similar ring N' will be interposed between the flange j and the ring M', the opposing faces of the rings M and N and the opposing faces of the rings M' and N' being formed with grooves to receive bearing balls, as shown in Fig. 3 of the drawings. The ring M' will be rigidly connected, as by an arm m', to the upright part A' of the main frame (see Fig. 6), and from the ring M will extend a hand lever M², whereby the ring M may be turned. The hand lever M² will be provided with a grip lever M³, pivotally connected thereto, as at m² (see Fig. 9), the inner end of this grip lever being adapted to engage a segmental rack plate a⁴, that is bolted to the top of the upright part A' of the main frame.

From the foregoing description it will be seen that when it is desired to start the locomotive (it being assumed that revolution has been imparted to the crank shaft J from the engine) the operator will turn the hand lever M² in upward direction (see Fig. 6), thereby causing the teeth of the movable ring M to ride against the inclined teeth of the fixed ring M' and force the friction member or wheel K outward until its cone rim bears against the conical face of the ring K' of the fly wheel K². Revolution will then be transmitted from the fly wheel to the clutch member K, its pinion k, and thence by hand lever H' and pinion G to the train of gears B², F, and E² and to the wheels of the locomotive. The direction of travel of the locomotive will be determined by the shifting of the pinion G by means of the hand lever H', in the manner hereinbefore described.

Upon the top of the main frame A' is mounted the cylinder P of a gasoline or like explosive engine. The front end of the cylinder P has its piston connected to a cross head p, from the ends of which lead rods p' to the portions j' of the crank shaft J. The piston within the rear part of the cylinder P will be connected by a piston rod with the central portion j² of the crank shaft. The cross head p at the front of the piston will be supported by links p², that are pivoted to an extension A³, bolted to the front of the main frame. The crank shaft J is shown as provided with a fly wheel R at its right hand end, and a pinion s, mounted on the crank shaft, meshes with a gear wheel s', that is keyed to a shaft S, journaled in the main frame. The shaft S serves to operate the valve mechanism of the engine and as well also to operate the igniter mechanism.

Four claims. Application filed Jan. 16, 1899.

BRITISH PATENTS.

No. 12,552—Sept. 23, 1899—Motor Road Vehicle.—John H. Munson, La Porte Ind., U. S. A.

The inventor states that his invention provides a motor vehicle having an equipment of minimum weight, and the operating power of which will always be in exact proportion to the load to be moved and the condition of the road to be traversed; a lighter and cheaper construction as well as durable and easy to keep in working order, and the inventor aims to provide a motor vehicle which may be operated at a low cost, etc.

The arrangement includes a storage battery, an electric motor-dynamo, four Otto cycle engines and speed-varying clutches. The engines are provided with double exhaust ports and cooled with water in the usual manner. The mufflers and vaporizers may be of any suitable construction.

Some work has been done on these lines by other inventors and from a purely practical point of view the vehicles have proved unwieldy and complicated. The patent under consideration is of the combination type, with some 19 figures and 33 claims, the first claim reading as follows:

"A motor vehicle propelled by means of an explosion engine carried thereby, said engine having secured on its crank shaft the armature of a motor-dynamo so arranged and connected to a storage battery that the surplus power of the engine when running light may be utilized to charge the battery, and when the full power of the equipment is required the engine may be reinforced by the motor dynamo actuated by the electric energy stored in the batttery." Application filed June 16, 1899.

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

Are You Interested in the Automobile Enterprise? I have experience and anxious to engage in the business, but haven't the capital. Educated and refined; references. Please write me. A. L. DYKE, Electrical Engineer, Hope, Ark.

SITUATION WANTED.

Mechanical expert, American, age 30; successful manager in manufacturing; economical, systematic, has equipped several plants, familiar with best machinery of to-day, very close buyer, plenty of resources in originating and perfecting; wide experience in gasoline engine work; has designed two gasoline automobiles, can design a new one for you; desires permanent and responsible position, where good work will be appreciated. Numerous references as to character and ability. Address, "EXPERT," care THE HORSELESS AGE.

Winton motor carriage for sale cheap; has single and double seat, single seat with cover, double seat back to back, and can be changed to one or the other in 10 minutes. Carries four people. Can be seen and tried. On receipt of 25 cents will send photo of double seat. Reason for selling, am having special Winton built. J. Moodie, Jr., care Eagle Knitting Co., Hamilton, Canada.

FOR SALE.

Model 1, Stanley Locomobile, has not been run 75 miles. Is in perfect condition. Immediate delivery on receipt of certified check for $600. ARTHUR S. THOMSON, 66 Broadway, New York.

FOR SALE.

Locomobile, perfect running order. Gong and duplicate chain included. $650.00, cash with order. E. L. STRONG, 112 Superior Street, Cleveland, Ohio.

WANTED.

A Stanley "Locomobile," 2½-inch tires preferred.

F. R. F., care of HORSELESS AGE.

GASOLINE ENGINE CASTINGS. Unfinished and partly finished. Soft, clean and easily worked. 1½ h. p., $25.00; 2½ h. p., $40.00; 4 h. p. $50.00. See our Adv. in Steam Boiler Number, December 6. MIANUS MOTOR WORKS, Mianus, Conn.

....CHAINS, SPROCKETS, COMPENSATING BEVEL GEARS....

GEAR WHEELS EVERY STYLE OR SIZE.

Send for Catalog A.
3,200 Sizes of Gears..

BOSTON GEAR WORKS, Boston, Mass.

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of THE HORSELESS AGE, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

Graphite Lubricants,

ALL KINDS, ACCORDING TO WANTS.

Special preparations for Gears of Electric Motors and for Cylinders of Motor Engines. **Send for Circulars and Prices.**

Joseph Dixon Crucible Co., - Jersey City, N. J.

DRY BATTERIES
For Sparking Gas and Gasoline Motors.

LONG LIFE, RELIABILITY, HIGH VOLTAGE.
IN SUCCESSFUL USE FOR THIS PURPOSE.

Dow Portable Electric Assistant Co., 218 TREMONT ST., BOSTON, MASS.

Seamless Cold Drawn Steel Tubing, Shells, Cylinders and Tanks, For Air, Gas, Steam, Ammonia or fluids under pressure and explosives. ☞ Seamless Steel Tested Tanks of Sundry Diameters.

DROP FORGINGS AND STEEL STAMPINGS.

JANNEY, STEINMETZ & CO., Drexel Building, Philadelphia, Pa.

BALDWIN DETACHABLE CHAINS made for Automobiles, in sizes to suit all requirements. Prompt deliveries made. Address:

BALDWIN CYCLE CHAIN CO.,
WORCESTER, MASS., U. S. A.

FOR SALE.

At a low price, a Bollee three wheeler. In fine condition. Fully described in November, '98, HORSELESS AGE. ARTHUR STAPLES, 55 Franklin Street, Lowell, Mass.

WANTED.—*Vol. 1, No. 1, Vol. 2, Nos. 5, 6, 7, 8, 9, 10, and Vol. 3, No. 1.* A new number of the weekly will be given in exchange for any one of these, *if in good condition*, and for Vol. 1, No. 1, four numbers will be given if in good condition. HORSELESS AGE, American Tract Society Building, Nassau and Spruce Streets, New York.

WANTED.

Special contributors to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS

VOL. V. NEW YORK, NOVEMBER 22, 1899. No. 8.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

Park Rules Relaxed.

President Clausen, of the New York Park Board, has become a convert to the automobile and given his consent to the admission of motor carriages to Central Park. His two associates on the Board had all along been in favor of admitting them.

The explanation given for the President's conversion to the new locomotion is that he conquered his prejudices enough to tempt fate in an automobile which was placed at his disposal by friends of the cause and was soon brought under the spell of the machine. The wholesale runaways he had pictured in his imagination did not occur. The manipulation of the machine, which he had regarded as possible only to trained mechanics, he found from personal experience to be only a matter of ordinary intelligence and sufficient practice. His objections having been proved unfounded, he announces that a new rule will be adopted, granting the privilege of the Park to a limited number of automobilists until the horses are accustomed to them and the Board considers it safe to remove all disability from the motor carriage. The permits will be restricted to those who, in the judgment of the Board, are cautious and competent drivers of motor machines.

This concession of the New York Park Board and the reported breach of the Fairmount Park rules and subsequent fining of the delinquent bring up the whole question of the extent of the jurisdiction of public park authorities and the intent of the word public as applied to highway, boulevard or driving park. The question is not new, and the legal principles underlying it are well established. According to these principles, strictly interpreted, the Philadelphia authorities have no right to exclude motor carriages from any of the drives in Fairmount Park, nor have the New York authorities any right to issue permits to automobilists to enter Central Park. Such permits are unnecessary. Any automobilist conducting himself with ordinary decorum and observing the common laws of the road is entitled to admission on the same terms as the driver of a horse, and laws regarding the competence of drivers of automobiles are not to be thought of unless a like surveillance is to be kept over drivers of horses, which are the more dangerous of the two.

But notwithstanding that the broad principles of the law are on the side of the automobilists, it is doubtful whether it would be wise to press the issue at this time. The park authorities have made important concessions, showing that they are becoming reconciled to the automobile. Their complete conversion is only a matter of a little time, and their present attitude of conservatism is dictated by a sense of duty to the public, and is not altogether indefensible. Under these circumstances, therefore, patience on the part of the automobilists and further personal experience on the part of the park authorities will soon accomplish all that is desired.

Public Motor Services.

Our English correspondent furnishes most encouraging evidence of the growth of public motor services in England. The demand for such vehicles is just as great here as in England, but the Lead Cab promoters have led us astray and diverted attention from productive lines of development, and we have consequently lost valuable time in this more important branch of the industry. With renewed attention being given to steam, gasoline and kerosene motors in the United States greater activity may be looked for, however, in the line of public motor vehicles. The commercial end of the business is the most permanent and the most profitable. Our pleasures change, but commerce always and everywhere is in search of economy.

Anglo-American Angling.

The ridiculous Anglo-American promotion scheme mentioned in our last issue fell with a thud. It was so absurd and inopportune that nobody took it seriously, commenting rather on the reckless extravagance which prompted these old campaigners to put up so large an incorporation fee in the present state of motor stock-jobbing in America, which between wind and water is completely becalmed.

If they should remove three ciphers from their capital stock they would be approaching a business basis.

The President is Initiated.

President McKinley has tasted the joys of a ride in an automobile. He was seen early this week in the steam carriage of F. O. Stanley, the inventor of the Locomobile. Now that the horseless carriage has won the approval of the Chief Magistrate, its popularity will gain a decided impetus.

The Locomobile Co. seem to be the only ones who appreciate what a splendid market Washington is for motor vehicles. Washington teems with wealthy people who are seeking some healthful diversion or amusement, and who would willingly invest in automobiles if they could see them; but the idea of ordering machines by mail without being able to see for themselves what they will do and what they look like does not appeal to them. The Locomobile Co. is reaping the reward of its enterprise.

Fairmount Park Rule Contested.

Mrs. Jules Junker, wife of a wealthy Philadelphia automobilist, was fined $5 the other day for driving an automobile on forbidden boulevards in Fairmount Park.

The attorney for the defense argued that the Park Board had passed a rule permitting the use of certain drives by automobiles, but had passed no rule prohibiting their use on the other drives. The magistrate, however, decided that a park rule had been violated and imposed the fine.

Mrs. Junker intends to appeal the case.

Single Tube Tire Co.

Last Saturday the Single Tube Automobile & Bicycle Tire Co. was incorporated at Trenton, N. J., with a capital of $1,000,000 to acquire the Tillinghast patent from the Tillinghast Tire Association. The incorporators are Col. Theodore A. Dodge, Herbert L. Griggs, E. Mora Davison, Geo. W. Young, Camillus G. Kidder, George Pope, Charles Smithers, L. K. McClymonds and William A. Towner.

The meaning of this incorporation is that the Rubber Goods Co., headed by Chas. R. Flint, has obtained control of the Tillinghast patent.

An Austrian Electric Coupe.

Horseless vehicles are beginning to become more prominent in Austria, although few firms in that country have so far entered into the new industry. One firm, however, which has been devoting itself to the construction of motor vehicles for some time past is Jacob Lohner & Co., of Porzellangasse 2, Vienna IX., both electrical and petroleum motor vehicles being now turned out by this concern. The accompanying illustration shows the Lohner two-seated electric coupé, propelled by a 5 h.p. electro-motor, geared by spur wheels to the front axle. A noticeable feature about the vehicle is that the

ELECTRIC COUPE OF JACOB LOHNER & CO., VIENNA.

front wheels, which act both as drivers and steerers, are of a larger diameter than the rear wheels. The battery, which is located under the driver's seat, comprises 42 cells of a capacity of 100 ampere hours, the weight being given as 828 lbs. The controller is arranged to give four forward speeds and a reverse motion, while in one position the motor is made to act as a brake. In addition to the electric brakes, tire brakes, operated by a foot pedal, are provided. Steering is effected by a bar, while the wheels are of wood fitted with solid rubber or pneumatic tires, as desired. The makers state that a distance of from 25 to 50 miles can be covered on one charge of the battery, according to the condition and gradients of the roads traversed. The Lohner Co. are also making a three-seated coupé on similar lines.

A company has just been formed in Rome, Italy, with a capital of $1,000,000, to be known as La Società Romena per L'Esercizio e le Costruzione di Automibil e Affini. The new company intends not only to inaugurate public motor services, but also to manufacture and sell verious types of vehicles, and will establish a number of motor vehicle store rooms and recharging stations.

Tillinghast Single Tube Tire Upheld.

A very important decision affecting the manufacture and sale of motor vehicle tires was recently handed down by the United States Circuit Court of Massachusetts in the case of Theodore A. Dodge, trustee of the Tillinghast Tire Association, vs. the Reading Rubber Tire Co., which had been in litigation about four years.

TEXT OF THE DECISION.

This suit relates to patent No. 497,971, granted May 23, 1893, to Pardon W. Tillinghast, for a pneumatic tire.

The patent describes a single tube pneumatic tire composed of two annular rubber tubes with intervening fabric all vulcanized together and forming a complete integral tire having all of its component parts securely united.

Previous to the Tillinghast tire the double tube pneumatic tire was in common use. It was to overcome what the patentee regarded as defects in the double tube structure that he invented his single tube tire.

In defining the invention Tillinghast says in his patent:

Heretofore pneumatic tires have been constructed with an interior air tube of vulcanized rubber, provided with a covering of canvas, and a separately vulcanized outer rubber covering having all its joints and parts cemented together after vulcanization. Tires so constructed, however, are liable to be rendered useless, owing to the chafing and wear of the parts in contact with each other, and the cemented joints are liable to separation under the strain caused by the constant flexing of the tire at the tread.

It is the object of my invention to provide a tire which will be free from internal chafing, and that will have no joints or parts cemented or otherwise connected after vulcanization, to become separated by use, and that can also be more readily attached to the rim of the wheel, and be easily repaired.

My invention consists in the combination of an annular inner rubber air tube, an outer rubber covering, and an intervening layer of braided or woven fabric, the several parts being joined to form a complete annular tire, while the rubber is in an unvulcanized condition, and then all vulcanized together, so that the textile layer will become attached by the process of vulcanization to both the inner rubber tube and the outer rubber covering, and when a loosely woven or braided fabric is employed the air tube and the outer rubber covering will also be united to each other through the interstices of the fabric, the textile covering of the air tube serving to prevent the bursting of the said tube when subjected to pressure, and at the same time allowing the side walls of the tire to yield freely when passing over an uneven surface.

The claims in controversy are as follows:

1. A pneumatic tire, consisting of a rubber air tube, and outer covering, substantially as specified, with the ends of the air tube and other component parts securely united by vulcanization, substantially as described, thereby constituting an integral complete tire.

2. A pneumatic tire, composed of a rubber tube, an intermediate layer of fabric, and an outer covering of rubber, substantially as described, having all its rubber joints and component parts simultaneously vulcanized together, forming an integral annular tire.

The evidence shows that Tillinghast invented his single tube pneumatic tire and disclosed it to others, as early as the summer of 1890, and that, consequently, his invention antedates the Boothroyd article in the Cyclist, describing a single tube pneumatic tire, which was published in England in December, 1890.

In the summer of 1890 Tillinghast was engaged in perfecting several other improvements in bicycle tires which he thought at the time would yield him a more immediate pecuniary return than his single tube pneumatic tire. These improvements related to a puncture-proof tread and an automatic pump; and between April, 1891, and July, 1892, he was granted five patents covering these inventions.

He first applied for a patent for his single tube pneumatic tire Nov. 20, 1891. This application was several times rejected and several times amended. On Sept. 2, 1892, he withdrew his first application and filed a new application, with a request that it be substituted for the old one. This request was granted, and the patent was finally issued on May 23, 1893.

Under these circumstances there is no ground for holding that the patentee is chargeable with any such laches in taking out his patent as to render it void. Hubel v. Dick, 28 Fed. Rep., 132, 140; National Cash Register Co. v. Lamson Consolidated Store Service Co., 60 Fed. Rep, 603.

The principal defense in this case is that the Tillinghast patent, in view of the prior art, is void for want of invention.

In considering the prior art as bearing on the validity of this patent the evidence discloses several things which should be borne in mind. Although the rubber tire art goes back to 1877, Tillinghast was the first to produce a practical and efficient single tube pneumatic tire. His invention was not a mere improvement upon prior structures of the same type. The device has proved of great utility, and marks a distinct advance in the art. The Tillinghast tire to a large extent has supplanted in this country all other kinds of tires used on bicycles.

The history of the rubber tire art exhibits several distinct types, known respectively as the solid tire, the cushion tire and the pneumatic tire. The advantages derived from the solid and cushion tires are due to the resiliency of the rubber. The pneumatic tire does not depend upon the resiliency of the rubber, but upon the resiliency of the air with which it is inflated. The highly compressed air furnishes the highest degree of resiliency, and the elasticity of the rubber is only incidentally made available. Previous to the Tillinghast invention the only practical pneumatic tire known was the Dunlop tire. This tire consisted of two tubes. It was constructed of a vulcanized inner rubber air tube and a separately vulcanized outer cover, the air tube and the cover being separate from each other. The Dunlop tire was defective, owing to the chafing and wear of the parts in contact with each other, due to having the inner rubber air tube separate from the outer rubber cover. It was to overcome the objections to this form of tire that Tillinghast invented his single tube tire, composed of an inner air tube, an outer rubber covering and an intervening fabric, inseparably united by vulcanization.

There is nothing in the rubber tire art which can be seriously considered as an anticipation of the Tillinghast structure. The solid rubber tire and the cushion rubber tire were not adapted to be inflated, and are manifestly different in construction and function. The only prior structures which bear directly on the question of anticipation relate to pneumatic tires. This branch of the art, as revealed in the present record, comprises four patents of pneumatic tires, and the Dunlop tire, already commented upon. The earliest pneumatic tire is described in the Thomson patent of May 8, 1847. In this tire the air tube, composed of "sulphurized caoutchouc, or gutta-percha," is inclosed in an outer casing made of segments of leather riveted together. This casing also serves to attach the tire to the wheel rim. It is apparent that this structure is not an anticipation of the Tillinghast tire. Reference is also made to the three Thomas patents, dated March 12, 1889. In these patents the principal feature of novelty consisted in having the tread portion thicker or tougher than the other parts of the tire. These patents do not describe a single tube pneumatic tire having the structural characteristics of the Tillinghast tire. They do not disclose a single tube tire composed of an inner rubber air tube, and outer rubber cover, and an intervening fabric, all vulcanized together. The only other tire in the prior art at the date of the Tillinghast invention was the Dunlop tire. This tire, as we have already said, was a double tube tire, and it manifestly is not an anticipation of the Tillinghast device.

In the construction of a pneumatic tire, Thomson, in his patent of 1847, considered an outer cover necessary for the protection of the inner rubber air tube, but did not conceive the idea of making the inner rubber air tube an integral part of the outer cover. In the Thomas 1889 patent it was thought that a pneumatic tire could be made out of a single annular rubber tube without any intervening fabric. The Dunlop conception embodied a vulcanized inner rubber air tube and a vulcanized outer rubber cover which were separate from each other. This was the condition of the art at the time Tillinghast made his invention. He was the first to conceive the idea of making the inner rubber air tube and the intervening

fabric an integral part of the outer rubber cover, and so prevent the inner rubber air tube from creeping or chafing against the interior surface of the outer rubber cover. It is clear that the Tillinghast patent is not void for want of invention by reason of anything which is found in the prior rubber tire art.

Nor, in my opinion, is the Tillinghast patent void for lack of invention by reason of anything which is found in the prior rubber hose art, or in the prior rubber gasket art. It appears from several American and British patents that it was the common practice, previous to 1890, to manufacture rubber hose composed of an inner rubber tube and an outer rubber covering, with intervening fabric, all vulcanized together. As this is not disputed it is unnecessary to refer specifically to any of these patents. But, notwithstanding this fact, it still remains true that a pneumatic tire is quite a different thing from a rubber hose, and that each belongs to a distinct art. A rubber hose is a tubing of indefinite length open at both ends. It is not an annular pneumatic tube forming a tire. There is nothing in the structure of rubber hose tubing, nor in the various modes of producing such tubing, nor in the uses to which such tubing is put, which affords any suggestion leading to the production of a pneumatic tire. Nor does a rubber hose suggest that a tire having the structural characteristics of the Tillinghast patent would possess any special utility or advantages over other pneumatic tires.

Rubber gaskets were constructed substantially the same as the Tillinghast tire. They were used for making tight joints in a vessel for treating sugar cane and bagasse. They are shown in the Duval patent of 1887. The Duval structure comprises a large vertical chamber to hold the crushed cane. The chamber is closed at its lower end by a removable bottom which may be opened to permit the refuse solid matter to be discharged after treatment. The bottom must close against the lower end of the chamber with a tight joint, and to secure this result the joint is provided with a rubber gasket or packing ring. The specification of the patent says:

The said jacket has formed in its lower edge a circular groove, in which is received a tube, G, of India rubber, filled with water under pressure, the said tube forming a packing to make a tight joint between the said jacket and a movable trap, which serves to close the bottom of said jacket and that of the vessel A.

What has been said with respect to rubber hose may be repeated as to the rubber gasket, namely, that there is nothing in its structure, or in the mode of its production, or in the use to which it is put that affords any suggestion that a pneumatic tire having such structural characteristics would be of any special utility, or would solve the problem of a practical and efficient pneumatic tire.

In determining the question of anticipation of the Tillinghast patent based upon what was old in the rubber hose art and in the rubber gasket art, it is well to bear in mind the language of Mr. Justice Brown, speaking for the Supreme Court in Topliff v. Topliff, 145 U. S., 156, 161:

It is not sufficient to constitute an anticipation that the device relied upon might by modification be made to accomplish the function performed by the patent in question, if it were not designed by its maker, nor adapted, nor actually used, for the performance of such functions.

The inventive thought of Tillinghast was in the pneumatic tire itself, and not in the method of uniting two annular rubber tubes and an intervening fabric, which method may previously have been adopted for various purposes. The mere fact that it was old to vulcanize together an inner rubber tube, an intervening fabric and an outer rubber cover in the rubber hose art and in the rubber gasket art does not prove that there was no invention in the application of such a method of construction, with such modifications as must be made, to a pneumatic tire. Although hose pipes and gaskets had been manufactured for years prior to the Tillinghast invention, it did not occur to any skilled mechanic that their method of construction could be successfully applied to the production of a pneumatic tire.

From the best consideration I am able to give the question, I am of the opinion that there is nothing found in the prior art which anticipates the Tillinghast patent, and that, admitting the method of inseparably uniting by vulcanization an inner rubber tube, an intermediate fabric and an outer rubber cover was old in rubber hose and rubber gaskets, the conception that such a form of construction would produce a practical and efficient pneumatic tire constituted invention within the meaning of the patent laws of the United States. The pneumatic rubber tire art dates back half a century. This record does not show that either the Thomson patent of 1847 or the later Thomas patents of 1889 describe practical tires. The Dunlop double tube tire undoubtedly went into general use, but it was defective by reason of its duplex structure. Tillinghast, by uniting the different parts into an integral whole, overcame the defects in the Dunlop tire and produced a really efficient and practical pneumatic tire.

The Tillinghast invention may seem simple, now that it has been disclosed. This is often true of very important inventions. Upon this point it is well to remember the language of the Supreme Court in the case of Loom Co. v. Higgins, 105 U. S., 580, 591. In that case, Mr. Justice Bradley, speaking for the court, said:

It is further argued, however, that, supposing the devices to be sufficiently described, they do not show any invention; and that the combination set forth in the fifth claim is a mere aggregation of old devices, already well known; and therefore it is not patentable. This argument would be sound if the combination claimed by Webster was an obvious one for obtaining the advantages proposed—one which would occur to any mechanic skilled in the art. But it is plain from the evidence, and from the very fact that it was not sooner adopted and used, that it did not, for years, occur in this light to even the most skillful persons. It may have been under their very eyes—they may almost be said to have stumbled over it; but they certainly failed to see it, to estimate its value, and to bring it into notice. * * * At this point we are constrained to say that we cannot yield our assent to the argument that the combination of the different parts or elements for attaining the object in view was so obvious as to merit no title to invention. Now that it has succeeded it may seem very plain to any one that he could have done it as well. This is often the case with inventions of the greatest merit.

Let a decree be entered for an injunction and account, in accordance with the prayer of the bill.

Colonel Dodge wishes to call the attention of manufacturers and users of automobiles to the wide scope of this decision, involving as it appears to all single tube pneumatic tires. Bicycle tires sell for from $3 to $7 a pair, and the royalty upon them under the Tillinghast patent is 25 cents a pair. Motor vehicle tires are much more expensive, and at the same per cent. the royalty would reach a considerable figure, so that the interest of motor vehicle makers and users in this decision is even greater than that of the bicycle trade.

DENY THE SCOPE OF THE DECISION.

The Diamond Rubber Co., of Akron, O., an independent concern manufacturing bicycle and motor vehicle tires on an extensive scale, deny the applicability of this decision to the single tube tires they manufacture, and invite the holders of it to join issue with them in the United States courts of Ohio, Illinois or New York, as they have branch offices in the two last-named cities. They further guarantee to protect any and all parties selling or using their tires in the event of suits being instituted for alleged infringement. We call particular attention to the advertisements of both parties to be found elsewhere in this issue, as the decision is of great importance to the motor vehicle trade.

LONDON NOTES.

London, Nov. 9.

THE BRIGHTON RUN.

The arrangements for the run of the members and friends of the Motor Car Club to Brighton on Monday next are well in hand. A preliminary list that has just been issued shows that over 120 motors and cycles may be expected to take part in the event.

AN AMBITIOUS PROGRAMME.

The Automobile Club of Great Britain is contemplating for 1900 one of the most ambitious schemes it has so far projected. The full details of the scheme have not yet been elaborated, but the intention is to hold a series of trials at the end of March next, which should convince every one of the fact that horseless vehicles can no longer be regarded as merely in the experimental stage. These trials will practically constitute a tour of 1,200 miles—from London to Edinburgh and back, with halts of a day's duration at leading towns on the way to show provincial people the progress that has been made during the last year or two. The route will be through Bristol, Birmingham, Liverpool, Manchester, Leeds, Carlisle, Glasgow, Edinburgh, Newcastle, Sheffield and home again to London, the whole tour probably occupying about a fortnight.

MODERN STEAM WAGONS.

At a meeting of the Civil and Mechanical Engineers' Society, held in Westminster last week, a paper on "Modern Steam Wagons" was read by Geo. A. Burls, A. M. Inst. C. E. The paper covered very much the same grounds as that read by Mr. Thornycroft at the recent British Association meeting.

Under the head of "Total Cost of Running," Mr. Burls remarked that in the present state of the "steamobile" industry it was safe to say that the inclusive cost of running, after making liberal allowances under each of the above heads, did not exceed 5½ cents per net ton-mile, and that with coal or coke the fuel cost in many cases was as low as 2-3 cent; with oil fuel the cost might amount to 2 cents or more; the superior cleanliness and possibility of automatic firing with oil outweighs, however, in certain cases, the disadvantage of greater expense. The author supplemented his remarks with the result of a diarial account of the running of a steam wagon during a year. The total cost of running per working day comes out at $6.20 and the total cost per net ton-mile at 6 1-5 cents. The owners of this "steamobile" consider that it easily replaces three of their two-horse wagons—that is, six horses, three wagons, three drivers and three lads.

The author subsequently proceeded to describe the general arrangement and details of mechanism of a number of steam vehicles, concluding with an expression of confidence in the future of the automobile movement, not only for purposes of pleasure, but also for the transport of large quantities of goods over considerable distances.

THE AUTOMOBILE CLUB'S PUBLICATION.

Those connected with the recently formed American Automobile Club will be interested to learn that the Automobile Club of Great Britain has just commenced the issue of a little publication with the title "Automobile Club Notices." It is intended to take the place of the many notices which are from time to time issued to members, to afford to country members and others who cannot visit the club frequently information concerning the doings of and at the club, and generally to keep members in touch with the important work the club has in hand in the interests of the automobile movement.

MUNICIPAL MOTOR WAGONS.

The vestries in and around London appear to be showing unusual interest in the question of motor vehicles. In recent letters I have referred to the steps taken in this regard by the St. George's (Hanover Square) and Chelsea vestries, while now I learn that at a meeting of the Strand Board of Works last night it was moved that a motor dust van be employed on trial for two weeks. It was estimated that a motor of 3 tons weight would effect a saving of no less than $1,160 per year in the cost of dust collection and street watering. The proposition was carried unanimously. While the decision of the Strand Board of Works is one to be commended, yet in our opinion a couple of weeks' trial is hardly sufficient to bring out the economical and utilitarian features of horseless wagons. A couple of months would be a fair trial.

THE TARE WEIGHT OF HEAVY MOTOR VEHICLES.

A meeting of the Council of the Liverpool Self-Propelled Traffic Association took place on Monday last. There were present a large number of members, and also two Members of Parliament.

It was explained that the object of the meeting was to inform the Parliamentary representatives present of the proposal to have the law altered with regard to the regulation of motor traffic on highways, so that a wagon of 4 tons weight (unloaded) might be allowed for goods traffic of 3-ton vehicles, as at present.

The secretary said that a conference of societies interested in motor vehicles would be held in London on the 15th inst., at which the question of appointing a deputation would be discussed and a decision would probably be arrived at to approach the Local Government Board. Both M. P.'s promised to attend the meeting.

A BREWER'S STEAM WAGON.

Coulthard & Co., of Preston, have lately completed a 3-ton steam dray for a firm of brewers at Weymouth. The boiler, which is located in a cab in the fore part of the vehicle, is of the fire tube type, constructed for a working pressure of 200 lbs. to 225 lbs. per square inch. Liquid fuel is employed to generate steam. The dray is fitted with an air condenser, placed in front of the dash board. The engine is of the firm's special triple-expansion vertical type, and develops 14 b.h.p. when running at 500 revolutions per minute. Spur gearing is used to transmit the power from the engine shaft to the first motion shaft by means of clutches, while chains form the connection between the countershaft, the differential gear and the driving wheels. The gearing is aranged to give a ratio of 7, 11½ and 19½ to 1 between the engine and the driving wheels, the speeds being 2½, 4½ and 7½ miles per hour forward and 2 miles per hour reverse.

The vehicle is fitted with two brakes—a band brake on the second motion shaft and a shoe brake on the driving wheels. The water tank holds 65 gals. and the oil tank 25 gals. The vehicle is 15 ft. 6 in. long by 6 ft. 6 in. extreme width. The wheel base is 9 ft. 6 in. logitudinally and 5 ft. 8 in. center to center of tires transversely. The front wheels are of iron throughout, 2 ft. 9 in. diameter, and have tires 4 in. wide; the driving wheels are 3 ft. diameter, and have tires 5 in. wide, the front wheels being fitted on Ackerman's system controlled by worm gearing and a hand wheel.

Balanced Motors.

By Chas. E. Duryea.

On the subject of balancing motors a few thoughts worthy of mention seem to have been overlooked by the writers considering the subject. The real gist of the problem does not seem to have been grasped, and on this account useless work has been done, producing unsatisfactory results. Further, motors with multiple pistons may be perfectly balanced as machines and yet not run steadily as motors. Thus two pistons connected to 180-deg. cranks may be driven at any speed without vibration if their weights and travels balance, if their axial lines coincide and if the driving power be applied to the crank shaft.

If the axial lines do not coincide there will be a tendency to oscillate in a plane passing through said axes. Because of this, multiple cylinders should be set tandem or very close together.

When such a balanced machine is used as a motor, vibration exists. This cannot arise from the piston movement, for the pistons are balanced in the first place and their weight is not large in the second. Even were the motor a single cylinder one, the piston vibration is not a large factor. Suppose a 10-lb. piston making a 6-in. stroke in a motor of a 1,000-lb. vehicle. The piston starts at a standstill, accelerates for 3 in. and then retards for 3 in. It then repeats the process in a reverse direction, so that the total effect is one retardation plus one reverse acceleration in a travel of 6 in.

A simpler and equivalent statement is that the piston, weighing 10 lbs. moves 6 in. in the time required for a half revolution of the crank shaft and does work amounting to 60 inch-pounds. Action being equal to reaction, the carriage will in the same time be moved such a number of inches as multiplied by 1,000 will equal 60 inch-pounds, or 6-100 in. It is such a small item that any good upholstering would completely absorb it.

This fact, however, is no argument against balanced motors or light pistons. They are valuable features for other reasons.

The great cause of vibration is unbalanced torque. At each full explosion the fly wheel receives energy for half a revolution. The amount of this energy varies, but it is usually sufficient to drive the wheel several revolutions from a standstill. This fly wheel may reasonably be supposed to weigh ten times the weight of a piston, or 100 lbs. in a 1,000-lb. carriage, and have a radius equal to the stroke, in which case its mass, times the distance moved, would represent an effort thirty times that required to move the piston; and its effect on the vehicle would be very pronounced as compared with any unbalanced piston effect. Of course it will be readily seen that this torque reaction tends to move the vehicle around the crank shaft instead of in a direct line, as does the piston movement; but it is none the less present, although perhaps more easily resisted.

Having recognized it as the source of trouble, we may now rationally look for a remedy, and this is at once seen to be constant, instead of intermittent, effort. With the explosion motor as commonly used, effort is expended but about one-fourth of the time, so that at least four cylinders are required for constant effort. It is evident that two cylinders halve the size of the efforts, and double their number so that the vibration is but one-fourth as much as with a single cylinder of like power; while three cylinders reduce it to one-ninth and four eliminate it theoretically. In practice more than four cylinders would probably show favorable results, but each builder must decide for himself whether the increased complication would not overbalance the gain. The writer's experience indicates that the triple cylinder is most practical, all things considered.

A Study in Balancing.

By E. J. Stoddard.

C. E. Wisner, Illustrator.

DESCRIPTION OF ENGINE.

The two cylinders A and B, Fig. 1, have an explosion chamber, C, in common. We have shown the cylinders set at an angle to each other, but we believe that they can, and should, be substantially parallel. We shall be obliged for criticism upon this point, as well as any other.

Each cylinder has its own piston-connecting rod and shaft, E and F. Upon the shaft B is a fly wheel, G, and upon the shaft F a fly wheel, H. These two fly wheels have equal moments of inertia. I and J are counter weights having the same moments of inertia as their corresponding reciprocating parts would have if concentrated upon the crank pin.

The shafts E and F are geared to the main shaft D in a ratio of 1 to 2, so as to drive the main shaft in the same direction. K is an elastic member interposed between the main gear wheel L and the shaft D. The valves are operated from the wheel D.

The engine has been designed for greater power than would ordinarily be required, and the compression chamber has been made quite small, so that we shall have reserved power and so that in ordinary working we may put a tension upon the spring of the inlet valve, reducing the pressure of intake, silencing the exhaust and obtaining more complete combustion because of considerable ratio of expansion.

We design to regulate the speed by varying the power by the spring on the inlet valve.

INERTIA OF FLY WHEELS.

As the fly wheels revolve in opposite directions and are impelled by equal forces the turning moments upon the frame due to their acceleration are equal and opposite and therefore balance each other. The ordinates of the curves in Fig. 1 are proportional to these moments at different points of the stroke.

This effect is most noticeable when the engine is disconnected from the driving gear. When the engine is connected to its work the turning moment due to the acceleration of the fly wheel is reduced according as there is less or more give of the parts between the point of application of the power and the point of the periphery of the driving wheels which act upon the ground.

The turning moment acting to drive the vehicle must necessarily react upon the engine frame. This is incident to the action of any motor and cannot be avoided. If the chain of gearing between the application of the power and the point at which the work is done was rigid, we could not avoid a strain equal to the maximum twist of which the engine was capable. However, there is necessarily more or less give due to the elastic tires, etc. As the rigidity of the driving gear becomes

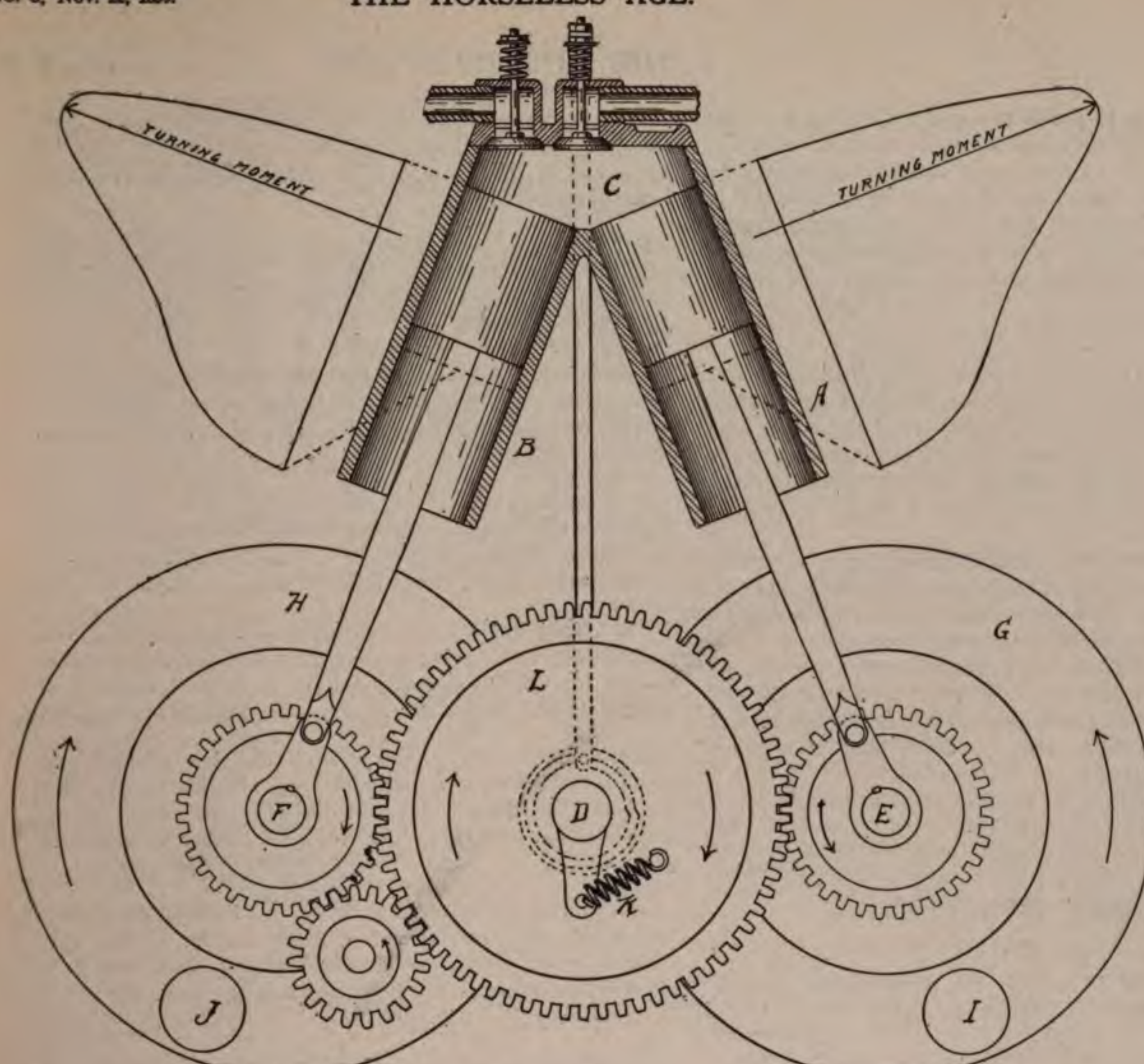


Fig. 1.

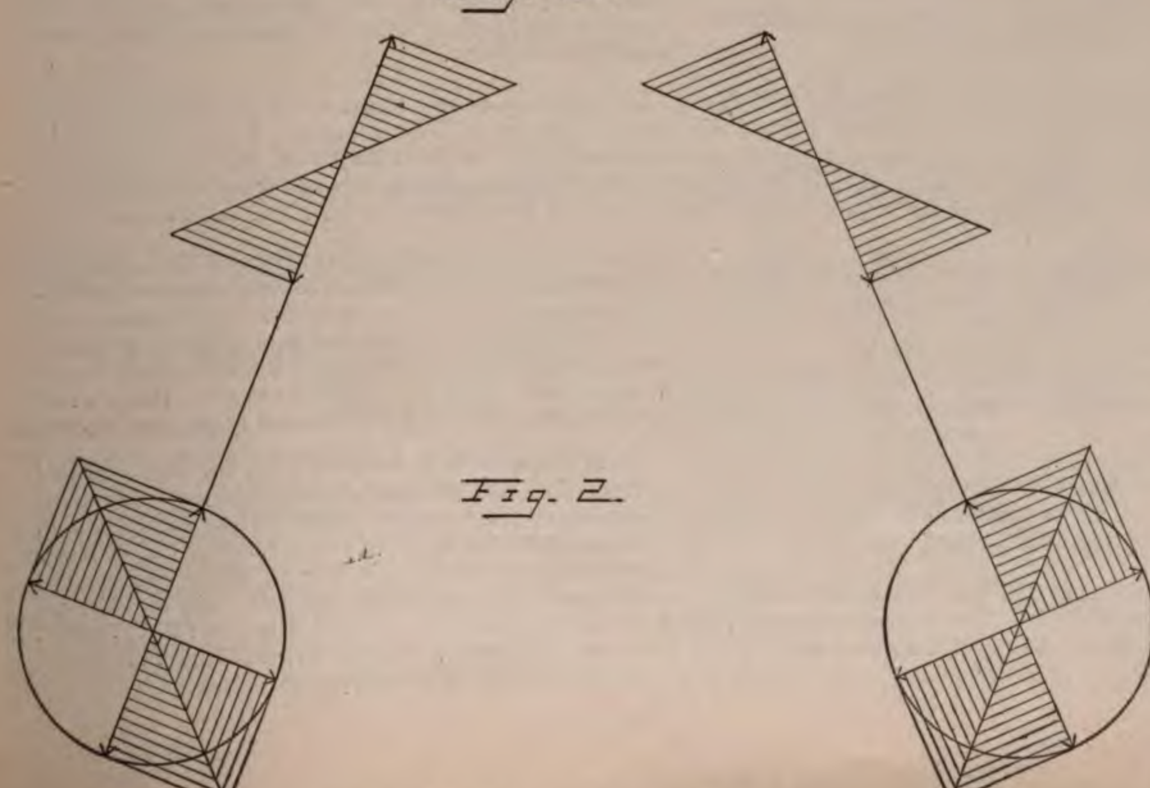


Fig. 2.

STUDIES IN BALANCING. ILLUSTRATED BY C. E. WISNER.

less the moment due to the inertia of the fly wheel becomes greater. We have therefore introduced an elastic member between the power and its application and have attempted to balance the moment due to the inertia of the fly wheels. It would seem to be axiomatic that where, as in the explosion of a gas engine, a force of 1 to 2 tons is applied in a twentieth of a second, it should be cushioned or confined to one or two rigid parts.

THE RECIPROCATING PARTS.

The diagrams of Fig. 2 represent the effect of the inertia of the reciprocating parts and their counter-balancing weights. The action of the reciprocating parts is in the line of the axis of the cylinders, and their magnitudes are in proportion to the ordinates of the straight lines, at different points of the stroke (see M N, Fig. 2), the angularity of the connecting rods being neglected.

The effect of the counter-balance weights I J may always be represented in magnitude and direction by a radial line (P. Q, Fig. 2), to their centers equal in length to the longest ordinates representing the force of the reciprocating parts.

The forces due to the counter-balance weights may be resolved into components in the direction of the axis of the cylinders, which completely balance the reciprocating parts, and into components at right angles to the cylinder axis. (See lower part Fig. 2.)

As the fly wheels turn in opposite directions, these latter components balance each other.

MINOR MENTION.

Geo. D. Brown, of Fargo, N. D., is said to be contemplating the manufacture of motor carriages.

Joseph Barsaleaux, Sandy Hill, N. Y., has invented a method of steering with the center-pivoted axle.

The project of establishing an automobile club in Philadelphia has been temporarily, at least, abandoned.

Postmaster Francis H. Wilson, of Brooklyn, N. Y., wants to introduce motor mail wagons. He prefers gasoline.

Otto Boyersdorfer, a bicycle repairer of Omaha, Neb., has completed a gasoline carriage weighing 265 lbs., built for his own use.

The Standard Welding Co., Cleveland, O., are recommending their Standard electrically welded seamless steel tube for automobiles.

The gasoline carriage built for W. D. Packard at the shops of the New York & Ohio Co., Warren, O., was recently given a satisfactory test.

The Badger Brass Mfg. Co., Kenosha, Wis., are manufacturing a special acetylene lamp for automobiles in a variety of styles and finishes, called the "Solar."

The Colonial Automobile Co. has been organized under Maine laws with $500,000 capital. The incorporators are Geo. N. March, Newton, Mass.; G. A. Dew, Melrose, and A. W. Kent, Boston, Mass.

The Thompson Automobile Co. has been organized in New Jersey with $60,000 capital and $3,400 paid in, by John K. Knox and W. F. Thompson, of Philadelphia, and Theodore Leas, of Camden, N. J.

F. J. Newman and Joseph Ledwinka, two Chicago inventors, are reported to have organized a company to manufacture electric vehicles in which the four motors are placed in the hubs of the wheels.

Quinsler & Co., carriage builders, Cambria St., Boston, Mass., have built 20 hansom cab bodies for the Columbia & Electric Vehicle Co., and are prepared to execute any kind of automobile body work.

It is reported that the Columbia & Electric Vehicle Co., Hartford, Conn., have received a contract for electric omnibuses to be operated on Fifth Ave., New York. The new omnibuses will seat 20 persons inside and four on top.

The Weber Gas & Gasoline Engine Co., Kansas City, Mo., will shortly erect a new plant for the manufacture of gasoline motors for vehicles of heavy weight to be used in the Arizona, New Mexico and other arid mining regions of the West.

President Clausen, of the Park Board, has relented and taken several rides in a motor carriage with his friends. He has also granted a permit to a friend of his who owns an automobile, but the right has not been further extended at present.

The Keating Wheel & Automobile Co., Middletown, Conn., are testing their new electric delivery wagon. It has two motors, wood wheels, 2½-in. solid rubber tires, and it is claimed the batteries can be charged in one hour for a run of 45 miles.

The Messerer Automobile Co. has been incorporated in Newark, N. J., with a capital stock of $300,000, of which $2,200 has been paid in. The incorporators are Stephen Messerer, Joseph Fisch, Julius E. Seitz and Adolph Goldfinger, all of Newark.

The daily newspapers report a run of 100 miles on one charge made by an electric carriage from Philadelphia to Atlantic City and return. The battery was manufactured by the Electric Storage Battery Co. and the operators were the engineers of this company, Messrs. Entz and Maxim.

The New Process Rawhide Co., Syracuse, N. Y., the well-known manufacturers of noiseless rawhide gears and pinions, have designed a special form of construction for motor vehicles, which secures the best results in this most exacting service. On receipt of specifications of pinion used and length of face of gear with which pinions are to mesh, they are prepared to quote on the best pinion suited to each special need.

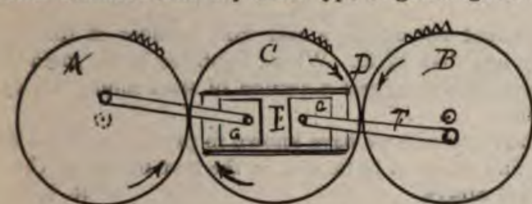
The National Cycle & Automobile Co. has been organized at Toronto, Canada, to manufacture bicycles and automobiles. The company secures control of the Stearns Bicycle Co., of Syracuse, N. Y.; the E. & D. Cycle & Linotype Co., of Windsor, Canada; the Christie and Wheeler saddle concerns and several small Canadian bicycle concerns. The directors are A. G. Spalding and A. L. Garford, New York; E. C. Stearns, Syracuse, N. Y., and A. A. Pope, Boston, Mass. F. S. Evans, of the E. & D. Co., is to be president.

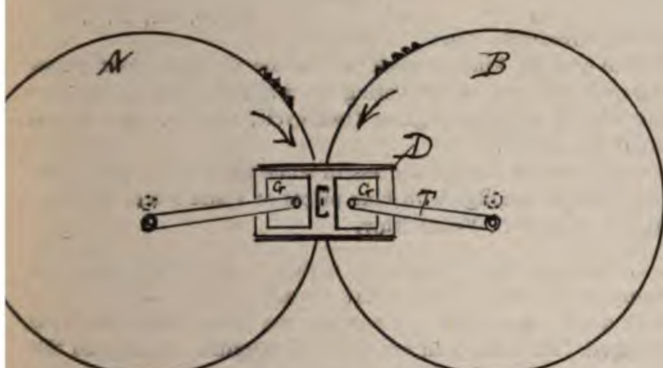
COMMUNICATIONS.

Another "Balanced" Idea.

Editor Horseless Age:

The accompanying pen sketch indicates the principle of a gasoline engine, which, owing to the fact that the explosions therein occur and expand between two equally yielding pistons in one cylinder, has no vibrations, is more effective and better balanced than any other type of gas or gasoline engine.





A, B and C are gears and fly wheels, either of which may have the shaft.

D are cylinders.

E—Explosion chamber in cylinder, acting simultaneously on both pistons.

F—Crank shaft.

G—Pistons.

QUESTIONS AND ANSWERS.

At the request of many of our readers we have decided to open a department of questions and answers. We will endeavor to answer any detail question in practical engineering pertaining to motor vehicles.

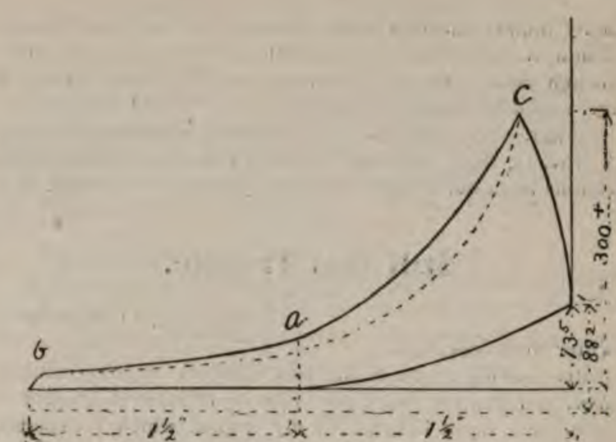
No Formula to Fit this Engine.

Minneapolis, Minn., Nov. 1.

Editor Horseless Age:

I have designed and am building a little gasoline engine, 3-in. cylinder by 3-in. stroke, in which the first half stroke gives no compression and the compression in the second half is about 90 lbs. absolute or 75 lbs. gauge, giving expansion to double volume before compression. From your formulas given in The Horseless Age the pressure at "a" on the sketch is 51.45.

Is there any formula to determine the pressure at "b" and the horse-power of the engine giving such a diagram? Will



the steepness of the slope of line "a c" be greater or less from the fact that the dilution of the charge is one-half the usual amount? I have not been able to make any satisfactory figures on the matter, but I have considerable curiosity to know how far the engine will vary from its theoretical value. I should say that the horizontal compression line is obtained by allowing part of the charge to escape from the cylinder and not by any special contrivance, as in the Atkinson engine. The crank in this engine is of the ordinary kind, with no extra levers in its construction. It would be a great favor if you could refer me to any place or work in which I could find approximately correct formulas for the proposed engine. I shall send you a diagram when one comes.

Very truly yours,

J. F. B.

N. B.—You will note that I have been studying your formulas in Horseless Age, but they do not seem to fill the bill for this construction, although they contain more information in the same space than is given by any other writer.

Answer: If we assume the approximate formula PV : : C for the expansion line, then the relation

$$\sqrt[3]{\frac{V}{V_1}} = \sqrt[4]{\frac{P_1}{P}}$$

between the volumes and pressures holds.

Assuming that the clearance (which you do not give) is about .5 in., the volume at the point where compression commences is 2 in. and at exhaust 3.5 in. Assuming that there is 50 lbs. at 2 in., at 3.5 in. there would be

$$\sqrt[3]{\frac{2}{3.5}} = \sqrt[4]{\frac{X}{50}} + \frac{X}{50} = \frac{2}{3.5}\sqrt[3]{\frac{2}{3.5}}\ X = 23.7$$

The total work done during this last stage would be $3A\ (P_1\ V_1 - PV) = 21\ (50\ (2) - 23.7\ (3.5)\ ) = 357$ inch-pounds; subtracting the work against the atmosphere, 1.5 (7) 15 : : 157 inch-pounds gives 200 inch-pounds, or about 10 foot-pounds as the net work.

I know of no work of the kind you inquire for.

E. J. STODDARD.

How to Reduce Vibration.

Anniston, Ala., Nov. 11.

Editor Horseless Age:

I am building a horizontal gas engine, single cylinder 6 x 8 (that is 8-in. stroke), fly wheel 20 in. diameter. Would you

kindly inquire through your columns how to reduce the vibration of this engine to a minimum? Any communications through your columns or addressed to "M.," care Horseless Age, would be highly appreciated.

Answer.—You will find some helpful suggestions on page 12, Nov. 15, 1899. We shall be pleased to receive further suggestions from our readers on this topic. R. I. C.

Still Has Trouble.

Akron, O., Oct. 28.

Editor Horseless Age:

After reading some of the late numbers of your valuable paper, and desiring more power in my vehicle, I decided to make some slight changes in my engine, which I expected would give me sufficient for my purpose.

First—I increased the diameter of the cylinder.

Second—Reduced the compression space to about 20 per cent.

Third—I increased the lift of exhaust valve to one-third the diameter of port.

Since putting engine together I have spent some days trying to make the thing run, and have not succeeded.

Other parts of the engine are the same as have been successful heretofore. Yours,

G. G. CROWLEY.

Every precaution is taken to secure accuracy, but obviously it is impossible to anticipate and provide for all contingencies; moreover, there is a provoking simplicity about a gasoline engine that is very deceptive and our friend must not assume plain sailing with any change he may undertake. But the mixture and ignition have been affected by the changes made, and a patient scrutiny of these details will, we trust, suggest the needful alteration. R. I. C.

Questions in Ignition.

Lynn, Mass.

Editor Horseless Age:

Please let me know what you consider the best electric ignition for a three-cylinder four-cycle gasoline engine, cylinder 3 x 3½ in.; also what is the size of coil, and proportion and size of wire used on the induction coil of the De Dion motor cycle, and do they use a vibrating circuit breaker? And if so, could the same thing be run by magnets instead of batteries? C. K. TRIPP.

We have been unable to secure the data desired. The De Dion motors in use in this country are imported and dimensions are not available. We purpose the publication of some details of a practical engine for motor cycles. The De Dion has a vibrating circuit breaker. You will find a description of a magneto ignition device for several cylinders on page 14, Sept. 20, 1899. R. I. C.

The De Dion Motor.

Roxbury, Mass., Nov. 10.

Editor Horseless Age:

What is the width of the ribs and thickness of the cylinder of the 1¾ h.p. De Dion motor? C. H. P.

1. Nineteen millimeters = ¾ in.

2. Three millimeters = 118-1000 in.

Explosive Pressures.

Albany, N. Y., Nov. 2.

Editor Horseless Age:

What is the lightest that a gas engine cylinder can be made to be safe? I am making a cylinder 4 x 3¾ in.; the wall, of gray iron, is 5-16 in. thick on upper half and ¼ in. at the lower, and has a brass water jacket, calked over. Is this heavy enough, or can it be lightened? Please give explosion pressures per square inch under regular high pressure engines.

C. F. W.

1. We would not advise a cast iron cylinder of that size being any less than ¼ in. Where lightness is the main object sought, would suggest a section of steel tubing for cylinder shell.

2. Highest pressure we have known in practice was 300 lbs. You will find tables of tests, etc., in the text books by Clerk, Donkin and others. R. I. C.

Lubrication of Wrist Pin.

Clyde, O., Nov. 9.

Editor Horseless Age:

Will you be kind enough to tell me through your paper the usual method of lubricating the wrist pin end of connecting rod of gasoline engines (two-cycle, marine, with closed crank chamber)?

Can you give me the address of some firm which sells complete sets of castings with blue prints of 1 and 2 h.p. gasoline marine engines? Yours truly, H. G.

1. First, a hollow wrist pin with a screw plug; when the crank is at lowest position the center of wrist pin is in line with a hole through outer casting, the latter hole being also plugged. Another plan noted on an English engine had the two holes connecting with a tube passing over a cup formed on wrist pin end of connecting rod. In larger engines I believe this has been supplemented by a grease cup reached through hand hole in casing.

2. Try Palmer Gas Engine Co., Mianus, Conn., or Mianus Motor Works, same place. R. I. C.

Gasoline Burners.

Amsterdam, N. Y., Nov. 9.

Editor Horseless Age:

We take the liberty of asking you if you know of a gasoline burner for a steam boiler. We have tried two, but they do not give us the amount of fire we want. Can you tell us how to make one or of some one that will sell one?

SMEALLIE BROS.

Favor us with particulars of those you have tried. In Steam Boiler Number we shall devote some space to burners. We refer you to our advertising columns. R. I. C.

Inlet and Exhaust Ports.

Jeannette, Pa.

Editor Horseless Age:

What should be the size of the inlet and exhaust ports of a two-cycle engine running at 600 to 800 revolutions, bore 6 in., stroke 6½ in.? F. S. R.

Answer.—Suggest 1¾ and 2 in.

What Causes Noise of the Exhaust?

Richmond, Va., Nov. 10.

Editor Horseless Age:

Why does a gas or gasoline engine make a noise with the exhaust?

Would an engine with long cylinder stroke make less noise than one with short cylinder?

Would it be possible to have the explosive mixture completely burned, so that no energy would be left and on exhausting no noise would take place?

If we had a long cylinder for experiment, say 3 yds. long, on exhaust would there be any noise? (Engine not to exhaust on four-cycle principle, but after each stroke not forced out.)

F. D.

1. The passage of gases at high pressures into the atmosphere causes the vibrations of matter manifested in the noise. The idea of the muffler is to lessen the pressure, at any one place, by increasing the number of passages.

2. To some extent. See No. 3.

3. If the pressure in cylinder falls to that of the atmosphere we fail to see how there could be any noise when communication is opened between interior and exterior. The idea of a long cylinder has occurred to many, and some ingenious attempts to save the pressure, which now goes out simply to agitate the surrounding air, have appeared in one form or another of compound engine. Several have been shown in The Horseless Age, and in this connection see "Gas Engine Cycles," by J. D. Roots.

R. I. C.

MISCELLANEOUS QUESTIONS.

Hamilton, O., Nov. 9.

Editor Horseless Age:

What size pump is required for pumping gasoline for an engine with a 3½ x 4 stroke, and the amount of gasoline for each explosion at 600 revolutions? Do the different speeds vary the amount of gasoline for each explosion, and how can we make complete combustion?

E. M. STEVENSON.

1. Would suggest ½ x ¾ in.

2. The amount varies according to the horse-power and the more or less perfect combustion. The intention is to pump enough, an overflow pipe conveying the surplus back to tank.

3. Note previous answer.

4. A complete answer would cover the entire theory and practice of explosive motors, and for obvious reasons a specific reply cannot be given.

R. I. C.

A New French Tire.

The voiturette of the Société des Voiturettes Leon Bollee, which arrived second in the race, Paris to Rambouillet and return, made this hard trip without the least injury to the pneumatic tires.

This is regarded as a great triumph for the firm of Torrilhon & Co., who furnished the covers for the drive wheel tire, which carries 715 lbs., is placed between the two motor cylinders and was therefore subjected to a very high temperature.

Up to the present no pneumatic tire has been found to resist such conditions.—La Locomotion Automobile.

GASOLINE CARRIAGE OF G. DORE, PARIS, FRANCE.

OUR FOREIGN EXCHANGES.

"La Mouche" Voiturette.

Among the prize winners in the Bordeaux-Biarritz race was a little gasoline carriage named "La Mouche," or the mouse, built by Teste & Morel, of Lyons, France.

"LA MOUCHE" VOITURETTE.

The frame is of cold-drawn steel tubing and a De Dion & Bouton jacketed motor furnishes the power.

The weight of the vehicle is 475 lbs. and the price $750.

In the race it made an average of 17 miles an hour.

Safety Steering Gear.

The Motor Car Journal has the following account of a device brought out by Geo. Iden, manager of the Motor Manufacturing Co., Ltd., and which is now adopted on the vehicles of that company. Our readers will note the few parts and the neat design which conduces to the parts retaining their relative position, even though the nuts or split pins should fail.

Each of the L-shaped axles of the steering wheels is provided with a crank arm or lever extending horizontally therefrom. These cranks are connected by a stout bar, each end of which is turned down at right angles and screw-threaded; the ends are free to turn in the crank arm. Toward one end of this coupling rod is pivoted, by means of a link or knuckle joint, one end of a rigid connecting rod, which at its other end is similarly attached to a crank arm or lever, known as the "tiller crank," operated by the steering handle or "tiller."

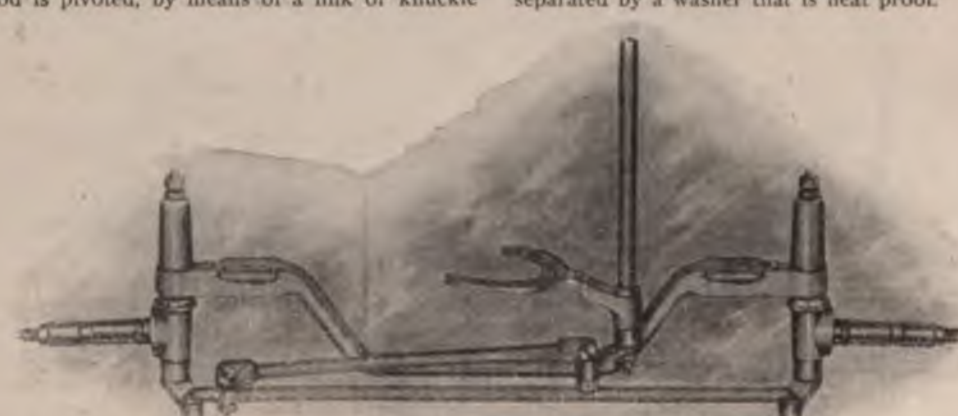
The shaft of this tiller crank is pivoted or journaled in a bearing mounted on a fixed part of the vehicle frame.

A Durable Ignition Plug.

A foreign contemporary gives a description of a new ignition plug manufactured by Bisson, Bergès et Cie, Paris, France. It is called the Helical Ignition Plug, because the secondary wire is not attached to it by a screw, as is usual, but is wound around the top of a helix which surmounts the plug, thus preventing the breaking of the porcelain by too sudden adjustment of the wire.

In the ordinary plug the rod in the center heats, expands and breaks the porcelain to which it is rigidly attached, and this liability to breakage is increased because one end of the porcelain is exposed to a high temperature while the other is subjected to cold air or rain.

Breakage is obviated in this new plug by the mode of fastening the induction wire, by fastening the rod to the porcelain at a single point, and by making the porcelain in two pieces separated by a washer that is heat proof.



THE IDEN STEERING GEAR.

Goodyear Pneumatic Tires.

The Goodyear solid rubber carriage tires have long been favorably known to the trade. The solid rubber tire business, however, was but a stepping stone for the Goodyear Co. to the pneumatic tire business, into which they have recently entered on a large scale, having equipped an extensive plant

exclusively for this purpose. The special advantage which they claim for their tire is the heavy fabric with heavy skim coat of rubber between each ply, so that the plies will not kink or separate in action, as is the case in many fine fabric tires.

The Goodyear Co. manufacture quite a number of standard sizes and are prepared to make any kind of pneumatics to order.

Battery Outfit for Starting Gasoline Engines.

L. H. Allen, 2427 Michigan Ave., Chicago, Ill., special agent for the Nungesser electric batteries, is putting on the market a set of dry batteries for starting motor carriages, consisting of 12 cells of the 1900 Nungesser batteries, box and primary coil all ready for use. The weight of the outfit is 33 lbs.

The coil is said to be thoroughly damp proof, is guaranteed up to 1,000 sparks per minute, and is wound specially for dry battery current. This set, if used two or three minutes at a time and for 15 to 20 minutes per day for starting purposes, will give from six months to a year's service.

The voltage is 6, the initial amperage on short circuit is 30, but a resistance coil reduces the flow of current to 2 amperes, which gives efficient service and long life.

Another distinctive advantage claimed for this set of batteries is that if they become polarized from heavy service or accidental short circuit, they can be recharged without being removed, the same as a storage battery, by connecting to an incandescent line with a lamp in circuit to the binding posts on outside of the box.

The No. 1 closed circuit battery for gas and gasoline engine ignition, is guaranteed to give 300-ampere hour service without attention of any kind.

Battery Facts.

This is the title of a little pamphlet issued by the Edison Mfg. Co., manufacturers of the well-known Edison-Lalande primary batteries, which are extensively used for sparking gas and gasoline engines. The title of the pamphlet is not a misnomer, for the Edison-Lalande batteries have been long enough on the market to establish a reputation among the largest users of both stationary and portable gas and gasoline engines, who in this pamphlet testify to their uniformly satisfactory experiences with them.

Quite a number of different sizes and types are furnished by the company, but the one specially recommended for boat and vehicle engines is the type "V" cell, with liquid-tight steel-enameled jar, or the "A A" cells, which have lower internal resistance than "V" and, consequently, greater available current.

They also have a new spark coil for gas engine work called the Edison, which contains 6 pounds of copper wire and therefore gives the required spark with less than half the current usually employed and saves the batteries to that extent.

They have recently moved to a new store at 20th St. and Fifth Ave., New York.

Aluminoid.

Motor vehicle manufacturers appreciate the need of an aluminum alloy which, while preserving the lightness and malleability of this metal, shall also possess sufficient tensile strength and stiffness to withstand the strains of mechanical use. The alloy known as "Aluminoid," now used by quite a number of manufacturers for certain parts of their vehicles, is giving very general satisfaction. It has the stiffness and tensile strength of steel, having been tested by the U. S. Government to a strain of 55,000 lbs. to the square inch.

"Aluminoid" castings and sheet for panels are made by the Hill, Whitney & Wood Co., Waltham, Mass.

MOTOR VEHICLE PATENTS of the world

UNITED STATES PATENTS.

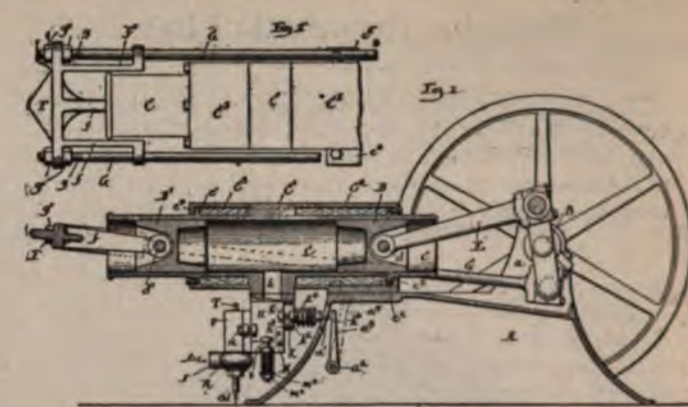
No. 636,048. Oct. 31, 1899—Gasoline or Gas Engine. Ernst H. Korsmeyer, Higginsville, Mo., assignor of one-half to Fritz Langkrahr, of same place.

Fig. 1 is a vertical section through engine. Fig. 2 is a plan of one end of cylinder. Fig. 3 is a vertical section of cylinder. Fig. 4 is a vertical section through valve mechanism. Fig. 5 is a horizontal section on line 5, 5, of Fig. 4. Fig. 6 is a view on line 6, 6, of Fig. 40.

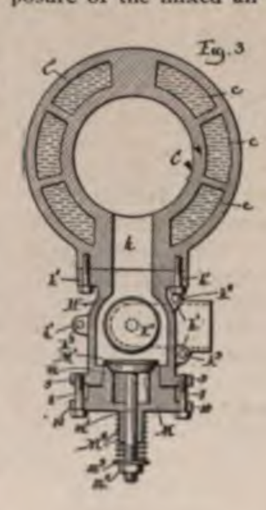
It will be observed that the annular spaces between the water jacket sections C^2 and C^3 and the cylinder C communicate with each other through the segmental chamber c, so that an effective cooling of the cylinder will be had, water being admitted preferably through an inlet in the top of the section C' and being discharged through an outlet pipe at the bottom of section C^3. The water section is shown as formed with lateral flanges c^2 (see Fig. 2) that will be bolted to the top of the bed A, and thus serve to hold the parts rigidly in position.

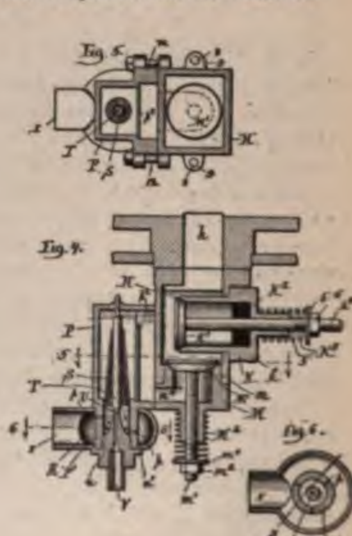
In the under side of the cylinder C is formed the admission and exhaust port h, and this port h, as shown in Figs. 1, 3 and 4, communicates with the interior of the valve casing or support H, that is bolted as at h (see Fig. 3) to the under side of the cylinder section C'. The valve casing or support H has an opening formed in its side, through which opening passes the seat casing K of the exhaust valve K'. The seat casing K has its reduced cylindrical portion k extending within the chambered valve casing H, and the seat casing K is furnished with an enlarged portion k', that bears against the side of the valve casing H and is provided with flanges k^2, through which pass the bolts k^3 (see Fig. 1), that engage flanges h' on the valve casing H and retain the seat casing K in position. The valve seat casing K is provided at one side with an exhaust port K^7, and through the casing K extends the stem k^4 of the exhaust valve K', this valve stem passing through an elongated bearing in the end of the casing K and being encircled by a strong coil spring, K^8, the outer end of which spring bears against a washer 5, the position of which washer may be adjusted by means of a nut 6 upon the threaded end of the valve stem k^4 in order to vary the tension of the spring K^8.

In the under side of the valve casing H is formed an opening to receive the reduced portion m of the casing M (see Figs. 3 and 4), the upper portion of this casing M being formed with a seat for the valve M', the stem m' of which extends downward through an elongated bearing and is encircled by a weak coil spring M^2, that serves to hold the valve M' normally against its seat. The tension of the spring M^2 can be varied by means of a nut m^3 upon the end of the valve stem m', this nut serving to shift the washer m^2, against which the lower end of the coil spring m^2 bears. The valve seat casing M is connected by bolts 8 with flanges 9 and 10, that project, respectively, from the bottom of the valve casing H and from the seat casing M. (See Fig. 3.) In one side of the seat casing M is formed a port m^4, that communicates with



the interior of the mixer casing P (see Fig. 4), that is attached to the valve casing H by bolts 12, that pass through flanges projecting, respectively, from the valve casing or support H and the mixer casing P. (See Fig. 1.) The bottom of the mixer casing P is formed with a downward extension P', provided with a series of perforations p, through which the supply of air will be admitted from a circular chamber R, that surrounds the extension P' of the mixer casing P and receives the air supply through the lateral opening r. Within the interior of the mixer casing P is the spreader hood S, preferably of conical shape and formed of wire gauze or like material, adapted to diffuse the gasoline and effect a better exposure of the same to the supply of air. The spreader hood S is connected to the valve T, the upper end of which passes through the top of the mixer casing, while its lower conical end rests upon the upper end of the oil valve seat U, through which the gasoline will be supplied by a pipe V, communicating with a reservoir. The valve seat U is of annular shape and is provided with a screw-threaded portion u to engage the screw-threaded lower part of the extension P' of the mixer casing, as shown in Fig. 4, and the valve seat U is provided with an exterior flange u', that projects beneath the air supply chamber R and serves to retain this chamber in position. Preferably the mixer chamber P is provided with a vertical transverse wall p^2 in order to insure a more thorough admixture of the air and oil and to insure also a greater exposure of the mixed air and oil or vapor to the hot wall of





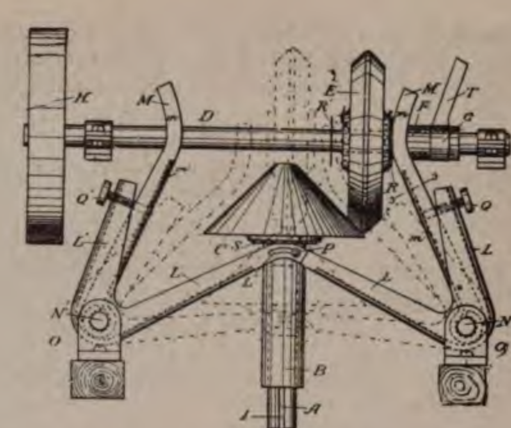
the valve casing or support H, as will presently more fully appear. By reference to Fig. 1 of the drawings it will be seen that the stem k^4 of the exhaust valve K′ projects through a cut-away space a', formed in the base or bed A, and through the side walls of the bed or base A extends a rock shaft a^2, that carries an arm, a^3, adapted at the proper time to contact with the stem k^4 of the exhaust valve and force this valve from its seat in order to permit the escape of burned gases after the explosion within the cylinder has occurred. Upon the outer end of the rock shaft a^2 is attached an arm a^4 (shown by dotted lines in Fig. 1), this arm being actuated in the usual manner for controlling the exhaust.

From the foregoing description the operation will be seen to be as follows: If it be assumed that the pistons D and D′ are at the extreme of their inward stroke or as close together as they come, then as they move outward toward the position shown in Fig. 1 air will be drawn through the air supply pipe R and will pass through the perforation p and up into the mixing chamber P, and as the air is thus drawn into the mixing chamber the spreader hood S will be raised slightly, thereby lifting the oil supply valve T from its seat and permitting a portion of oil to pass into the bottom of the mixing chamber. The mixed oil and air will be drawn through the spreader hood S, and thence over the transverse plate p^2, and thence downward along the hot wall of the valve casing or support H and into the ports m^1 of the seat casing M, the valve M′ having been lifted from its seat, and the mixed supply of air and oil or vapor will pass upward through the valve casing H and through the port h into the cylinder C until the trunks or pistons D D′ are at the extreme of their outward movement. The trunks or pistons D D′ will then move inward, thereby compressing the mixed air and oil, and when about the extreme of their inward stroke the explosion of the mixture within the cylinder C will be effected, thereby forcing the trunks or pistons D D′ outward to the position in Fig. 1 of the drawings. It will be understood, of course, that during this second outward movement of the trunks or pistons D and D′ the exhaust valve K′ and the valve M′ will be closed. When, however, the trunks or pistons D D′ reach the limit of their outward movement and begin to reverse, the lever arm a^3 on the rock shaft a^2 will contact with the valve stem k^4 and force the exhaust valve K′ from off its seat, thereby permitting the burned gases to escape from the cylinder C. It will be understood, of course, that the explosion of the mixed air and gas or oil occurs only at each second revolution of the crank shaft.

Eight claims. Application filed Nov. 18, 1896.

No. 637,202—Motion-Reversing and Speed-Changing Mechanism.—John C. Des Granges, Los Angeles, Cal., assignor to Hester Des Granges, same place. Filed Feb. 27, 1899. Serial No. 707,077. (No model.)

Claim.—A motion transmitting and reversing device comprising two cones, one on a driving and one on a driven shaft, both having a longitudinal movement on their respective shafts but non-rotative thereon; one of said cones being a double cone comprising two cones base to base and the other being a single cone, the conical surfaces of the double cone adapted to receive on either side of its common base the rolling contact of the conical surface of the single cone, and means to move the cones and to keep their conical surfaces in contact, whereby when motion is imparted to the driving



shaft a variable motion may be imparted to the driven shaft and the motion of the same may be reversed.

No. 636,999—Running Gear for Vehicles.—Robert W. Jamieson, Rochester, N. Y. Filed July 8, 1899. Serial No. 723,190. (No model.)

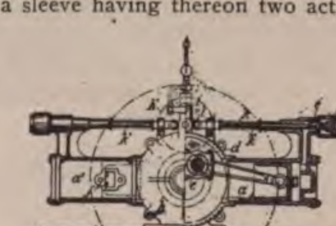
Claim.—In a vehicle-steering device, the combination with an axle secured to the vehicle frame, having arranged upon each of its opposite extremities one member of a segmental bearing struck from a center within the wheel hubs, or short

stud axles supported entirely in and by the wheels and provided upon their inner ends with a co-operating bearing member adapted to engage within the former member, and means for causing the simultaneous adjusting of the wheels.

There are 16 other claims.

No. 636,926—Fluid Pressure Engine.—Leon Serpollet, Paris, France, assignor to La Societe des Generateurs a Vaporisation Instantanee, Systeme Leon Serpollet), of France. Filed Nov. 18, 1898. Serial No. 696,801. (No model.)

Claim.—In a steam engine, a plurality of single-acting cylinders opening at one end into a common chamber, pistons in said cylinders, a driving shaft working in said chamber, pitmen connecting the pistons with said driving shaft, exhaust ports for the cylinders adapted to be opened or closed by the movement of the pistons themselves, inlet ports for the cylinder, outwardly opening puppet valves controlling said inlet ports, stems for said valves, springs acting on said stems to hold the valves normally closed, a rotatable cam, located between and adapted to act on the ends of said valve stems to open the valves against the tension of the springs, said cam comprising a sleeve having thereon two acting cam surfaces



tapering from their point of greatest width inwardly toward the middle of the sleeve but separated at their inner ends by a non-acting space, gearing for continuously rotating said cam during the running of the engine, and means for moving it laterally between the ends of the valve stems to bring either of the cams or a wider or narrower part thereof, or the non-acting intermediate space thereof, into alignment with said stems.

No. 637,015—Motor Vehicle.—Michael J. O'Donnell, Chicago, Ill., assignor to Joseph A. O'Donnell, same place. Filed June 15, 1899. Serial No. 720,689. (No model.)

Claim.—In a motor vehicle or cycle, the combination of a frame, drive wheels, an inner and outer driving flange on one of said wheels, a drive shaft mounted in fixed bearings, a suitable drive motor and connections to said shaft, swinging bearing arms pivoted concentrically with said drive shaft, a driven shaft carried by said swinging arms, drive gear between said drive and driven shafts, a drive pinion carried by said driven

shaft located between said driving flanges, extensions on two of said swinging arms, a rod connecting said extensions, and means connected with said rod for moving said swinging arms to throw said pinions into or out of driving contact with either of said flanges.

No. 636,965—Electric Vehicle.—Theodore B. Entz, Philadelphia, Pa. Filed Aug. 5, 1899. Serial No. 726,280. (No model.)

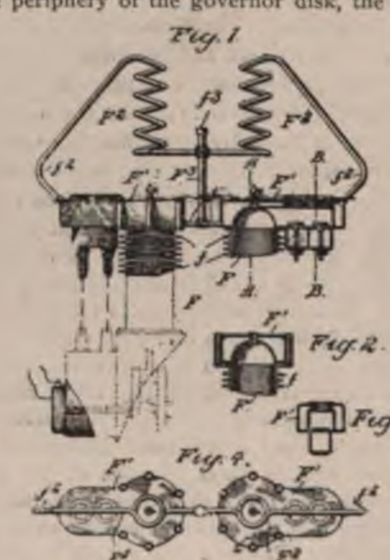
Claim.—An electric vehicle comprising a truck consisting of axles and wheels and perches or reaches rigidly attached to the axles, a motor on the truck, a battery box, a carriage body, and two sets of springs whereof one set is interposed between the truck and the carriage body and the other set is interposed between the battery box and the truck.

No. 636,964—Electric Vehicle.—Theodore B. Entz, Philadelphia, Pa. Filed Aug. 5, 1899. Serial No. 726,278. (No model.)

BRITISH PATENTS.

No. 6,914—March 30, 1899—Explosion Engines.—P. M. Justice (communicated by the Pope Mfg. Co.).

The motor F has a cylinder provided with radiating flanges f. The water jacket or cooling device is applied to the head of the cylinder and the adjacent portions of the valve boxes. The jacket F^1 around the cylinder head is tightly closed, the supply pipe f^1 being connected thereto at the lowest point, while the delivery pipe f^2 is connected thereto at the highest point. The radiating pipe F^2 rises from the delivery end of the chamber within the casing to the highest point, and is then coiled, in an open coil, to give the requisite length for radiation and consequent cooling of the contained water. A short pipe, F^3, affords a connection between the coil and the cooling jacket, as well as a moderate-sized reservoir, and its end is closed by a cap, f^3. The shaft of the motor has secured thereto an arm, G, to the ends of which are pivoted the weighted governor arms G^1, held normally toward the center of rotation by a spring, g^1. Links, g^2, connect the arms G^1 with a governor disk, G^2, mounted loosely on the motor shaft, so that the governor disk will rotate with the motor shaft, but its relative position thereon will be changed circumferentially by the action of the governor arms G^1; therefore, as the speed of the motor increases the cam g^3 on the governor disk will pass a given point a little earlier in its revolution with the shaft. Adjacent to the shaft and in the plane of the governor disk is pivoted an actuator, G^4, having a projection, g^4, to bear upon the periphery of the governor disk, the actuator being



held toward the disk by a spring, G^5. One side of the electric igniting circuit is connected to an adjustable contact screw, G^6, carried by the acuator G^4, while the other side of the same circuit is connected to a spring blade or vibrator, G^7. A lip, g^7, adjustable on the actuator G^4, is arranged to engage the end of the vibrator G^7, and to keep the same in a state of constant vibration. The end of the screw G^6 is so adjusted as to make its contact point encroach slightly upon the zone of vibration of the vibrator G^7 when the actuator G^4 is at the limit of its outward throw, the point of the screw being retained there for a brief period of time, dependent upon the speed of the engine and the legth of the cam g^3, so that the electrical contact between the vibrator and the end of the screw is made and broken several times. The contact screw is not permitted to encroach upon the zone of vibration of the vibrator sufficiently to stop or deaden the vibrations. The contacts are included in circuit with the battery and the primary winding of an induction coil, G^8, the secondary winding of the coil being connected with the sparking device G^9.

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

FOR SALE.

Perfectly balanced, valveless, gasoline carriage motor. Strong patents.

Address M. H., Care of HORSELESS AGE.

WANTED.

Automobile omnibuses. Parties engaged or about to engage in the manufacture of such vehicles, will please communicate with E. F. R., care HORSELESS AGE.

BODIES FOR MOTOR VEHICLES. We have just completed twenty hansom bodies for the Columbia and Electric Vehicle Co., using *our own* patented door and window operators, and are in a position to build anything in that line. Do you want anything in Automobile bodies? QUINSLER & CO., Cambria St., Boston, Mass.

FOR SALE.

Winton gasoline phaeton. Good as new ; only run 600 miles. Owner going to foreign country. Can be seen by appointment. Address,

G. G., HORSELESS AGE.

SUITABLE POWER FOR SMALL SHOP.

1½-horse power Hartig standard upright engine, hot tube igniter; used but a few weeks and replaced by larger engine. First class in every respect. Price, $50.00, fitted for gas; $65.00, for gasoline; $15.00 extra for electric igniter, without coil or batteries. Terms, 60 per cent. with order; balance, sight draft bill lading. Guaranteed as represented or money refunded. THE DENISON ELECTRICAL ENGINEERING CO., New Haven, Conn.

.... CHAINS, SPROCKETS, COMPENSATING BEVEL GEARS ....

GEAR WHEELS EVERY STYLE OR SIZE.

Send for Catalog A,
3,200 Sizes of Gears . .

BOSTON GEAR WORKS, Boston, Mass.

BALDWIN DETACHABLE CHAINS made for Automobiles, in sizes to suit all requirements. Prompt deliveries made. Address:

BALDWIN CYCLE CHAIN CO.,
WORCESTER, MASS., U. S. A.

Graphite Lubricants,

ALL KINDS, ACCORDING TO WANTS.

Special preparations for Gears of Electric Motors and for Cylinders of Motor Engines. **Send for Circulars and Prices.**

Joseph Dixon Crucible Co., - Jersey City, N. J.

WANT THE RIGHT

To manufacture an engine (any power) transmission device, etc., from some one who has patent on same, or would like to figure with manufacturers, paying them royalty, or use their product exclusively. Send drawings; state royalty and price outright. MANUFACTURER, care of H. A.

Seamless Cold Drawn Steel Tubing, Shells, Cylinders and Tanks, For Air, Gas, Steam, Ammonia or fluids under pressure and explosives. ☞ Seamless Steel Tested Tanks of Sundry Diameters.

DROP FORGINGS AND STEEL STAMPINGS.

JANNEY, STEINMETZ & CO., Drexel Building, Philadelphia, Pa.

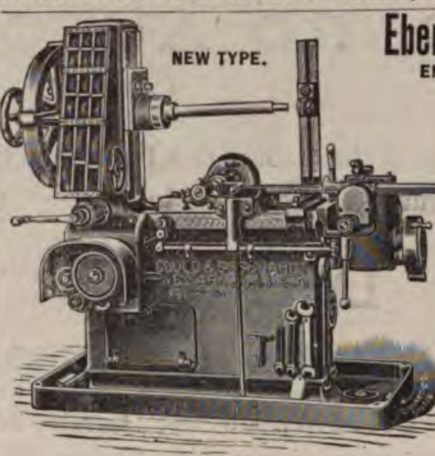
DRY BATTERIES

For Sparking Gas and Gasoline Motors.

LONG LIFE, RELIABILITY, HIGH VOLTAGE.

IN SUCCESSFUL USE FOR THIS PURPOSE.

Dow Portable Electric Assistant Co., 218 TREMONT ST., BOSTON, MASS.



"VICTORIA."
24 in., 33 in., 43 in., 63 in., 73 in. and 103 in.

Eberhardt's Patent
ENTIRELY AUTOMATIC

GEAR CUTTING MACHINES

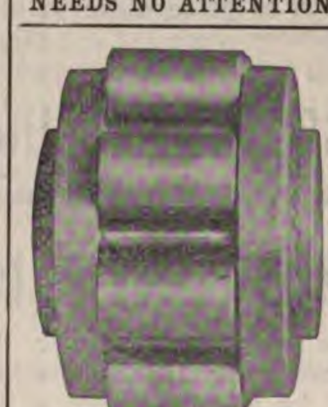
WITH
Eberhardt's Patent
"Radial Duplex" Gang Cutters.

2 to 10 teeth finished at once.

GOULD & EBERHARDT,
NEWARK, N. J.

The "A.R.B."

NO BALLS TO CRUSH
NO CAGES TO WEAR OUT
NEEDS NO ATTENTION



IS THE BEST AXLE BEARING FOR

MOTOR VEHICLES

It combines an AMPLE ROLLING SURFACE *with a* PURELY ROLLING ACTION ❧ *For* DURABILITY AND ECONOMY OF POWER IT IS UNEQUALLED

The FOREIGN PATENTS ARE FOR SALE

American Roller Bearing Company

27 STATE STREET
BOSTON, MASS.

SEND FOR CIRCULARS

Factory: 32 to 40 BINFORD STREET

VOLUME FOUR COMPLETE.

(April 5th to September 27th, 1899, inclusive.)

To New Subscribers for Two Years.

We wish to place these volumes in the hands of persons permanently interested and therefore offer them only to those who will subscribe for two years from April 5th, 1899. :: :: ::

SEND $4 AND GET THIS VOLUME BEFORE IT IS EXHAUSTED.

Complete Lines of **UPRIGHT DRILLS**

From a light Friction Drill to a 42-in. B. G. P. F. Drill.

SEND FOR CATALOGUE.

W. F. and John Barnes Co.,

996 Ruby Street, - Rockford, Ill.

LARGE CAPACITY SCREW MACHINE.

ESPECIALLY ADAPTED FOR MAKING PARTS OF MOTOR VEHICLES, MOTORS, Etc. . . .

LARGE CAPACITY. AMPLE POWER. RAPID.

Cut shows our No. 13 Machine with Wire Feed. Geared Friction Head, Power Feed and Gap Bed. Gap Bed gives very long Cross Slide and allows chips to fall through to pan. . . . .

Capacity with Wire Feed, . $1\frac{1}{8}$ inches.
Capacity without Wire Feed, $2\frac{3}{16}$ inches.

New Photo and Description ready. . . . . .

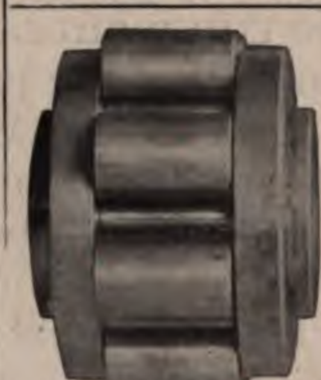
THE GARVIN MACHINE CO., SPRING AND VARICK STREETS, NEW YORK.

PHILADELPHIA STORE: The Garvin Machine Co., 51 North 7th Street, Philadelphia, Pa.

BERLIN: Deutsche Garvin-Maschinen-Fabrik Aktiengesellschaft, 17 Burg Strasse, Berlin C, Germany.

The "A. R. B."

NO BALLS TO CRUSH
NO CAGES TO WEAR OUT
NEEDS NO ATTENTION



IS THE BEST AXLE BEARING FOR

MOTOR VEHICLES

It combines an AMPLE ROLLING SURFACE *with a* PURELY ROLLING ACTION *For* DURABILITY AND ECONOMY OF POWER

IT IS UNEQUALLED

The FOREIGN PATENTS ARE FOR SALE

American Roller Bearing Company

SEND FOR CIRCULARS

27 STATE STREET
BOSTON, MASS.

Factory: 32 to 40 BINFORD STREET

Facts About Storage Batteries.

BY ISAIAH L. ROBERTS.

OTHER INFORMATION ON THIS SUBJECT BY WELL-KNOWN EXPERTS CONTAINED IN OUR

STORAGE BATTERY NUMBER. Issue of September 27th.

PRICE, 10 CENTS. STAMPS OR COIN.

THE JUMP SPARK LEADS.

GIVES THICK **1 inch Jump Spark.**

Weight, 3 lbs.

Dimensions 8 x 4 x 4 ins.

PATENT APPLIED FOR

C. F. SPLITDORF, Electrical Specialties, 21 Vandewater Street, NEW YORK.

HAND AND POWER PUMPS For Users and Makers of Automobiles and Pneumatic Tired Wagons. . . . . . .

GLEASON-PETERS AIR PUMP CO.,

MANUFACTURERS,

20 WEST HOUSTON STREET, NEW YORK, U. S. A.

½ to 2 H. P. Gasoline Motors

(WITH OR WITHOUT WATER JACKET)

FOR

AUTOMOBILES AND LAUNCHES.

VERTICAL OR HORIZONTAL.
ELECTRIC IGNITION. :: ::

☞ Large factory suitable for experimental work. Any style of carriage built to order from owner's drawings. Larger sizes for heavy vehicles in course of construction.

MALTBY AUTOMOBILE CO.,

10-12 Clinton Street, Brooklyn, N. Y.

FOR AUTOMOBILES

AND GASOLINE LAUNCHES
USE THE EDISON LALANDE BATTERIES.

LIGHT WEIGHT AND LIQUID TIGHT

CONSTANT CURRENT AND NO WASTE WHEN IDLE.

FULL DESCRIPTION IN BOOKLET NO. 5

EDISON MANUFACTURING COMPANY,

THOMAS A. EDISON, PROPRIETOR. 135 FIFTH AVENUE, NEW YORK.

The Woodruff Patent System of Keying...

Is used by The Largest Automobile Works in this Country For Keying Gears, Sprockets, Cranks, etc., to Shafts.

WE CARRY 41 SIZES OF KEYS AND CUTTERS IN STOCK AND MAKE SPECIAL SIZES TO ORDER.

SEND FOR CIRCULAR.

THE

WHITNEY MFG. CO.

HARTFORD CONN., U. S. A.

Size, 7 high X 4½ for Stationary Engines.
Size, 7 high X 4 for Automobiles.

O K DRY BATTERY.

NEW GAS ENGINE TYPE.

THE PROBLEM SOLVED.

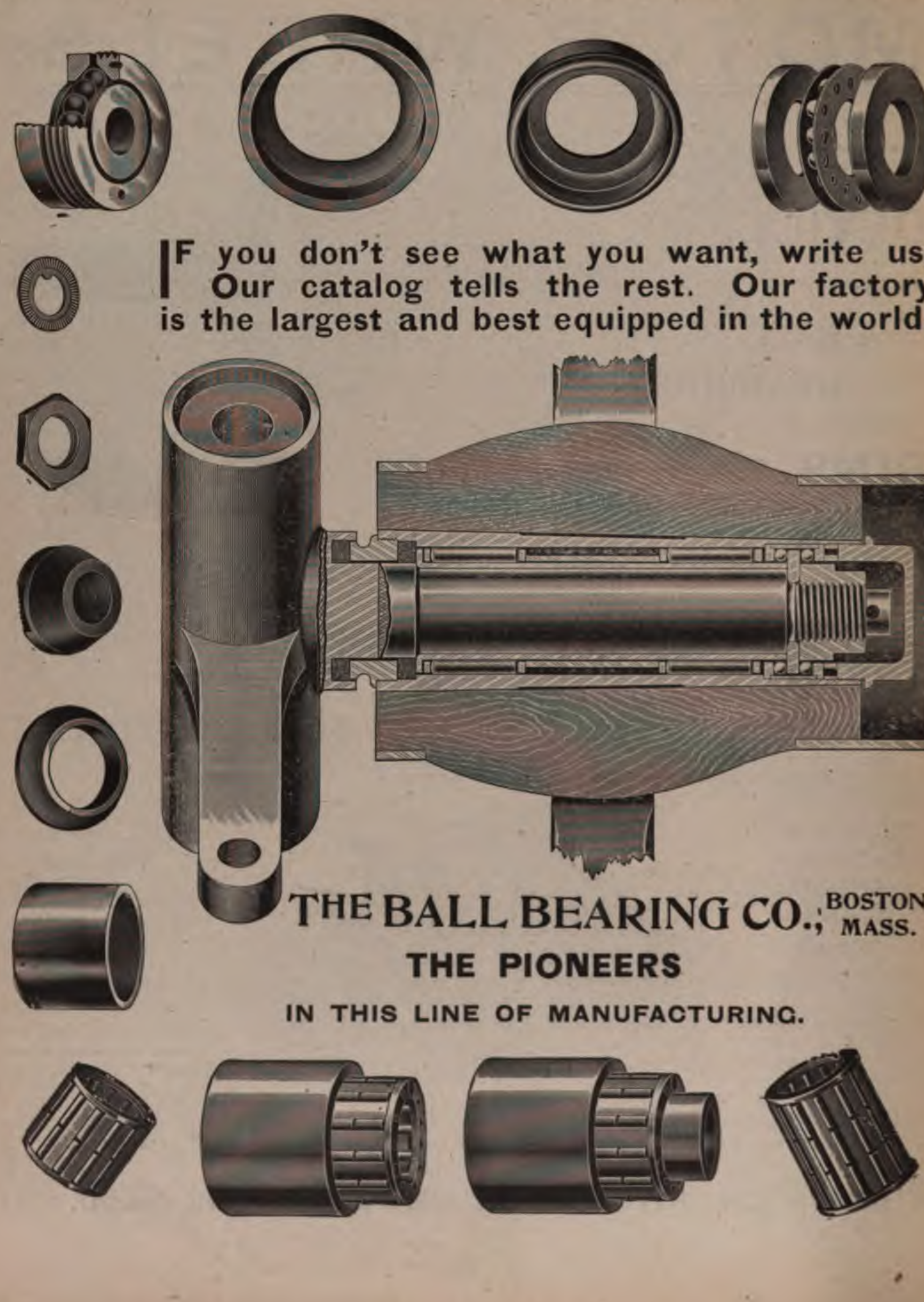
No solution to slop over. No missing of sparks. Highest voltage. Quickest recuperation. Long life. Unaffected by heat or cold. Compactness.

Non-Polarizing Dry Battery Co.,

625 BROADWAY, NEW YORK.

POINTS IN ORDERING.

1. Name of engine.
2. Number of revolutions per minute.
3. Number of sparks per minute.
4. Mode of ignition, whether by spark coil or induction coil.
5. If spark coil, whether butting or wiping spark.
6. Kind of spark contact points, whether platinum, steel or other material.
7. Average number of hours per day engine is run.


IF you don't see what you want, write us. Our catalog tells the rest. Our factory is the largest and best equipped in the world.
THE BALL BEARING CO.; BOSTON, MASS.
THE PIONEERS
IN THIS LINE OF MANUFACTURING.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS

VOL. V. NEW YORK, NOVEMBER 29, 1899. No. 9.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

The Time for an Exhibition is Ripe.

The time is ripe for an automobile show in New York. The increasing interest manifested in the motor vehicle by the more conservative portion of the public and the quiet but steady progress made underneath the surface by the more conservative manufacturers indicate the coming winter as an auspicious season to bring manufacturer and public together for a better understanding of each other. Having recovered somewhat from the blind infatuation that was the result of the promoter's spell, the people are eager to know something of the motor vehicle. It is to the interest of all that this desire for knowledge should be satisfied, and that the erroneous notions which have grown up in the promotion period should be dispelled by a closer acquaintance with the machine and its construction. Exhibitions are at all times educators, and as such should be encouraged. This is particularly true in the case of a new industry of such great popular interest, involving countless subjects that are in need of expansion. The demand for information is general. It is not only the public who are in search of further light on motor vehicles; the manufacturers present and to be, the agents, the mechanics, and all who are planning to take part in this great industrial development will welcome the opportunities which a motor vehicle exhibition would afford. The need then is apparent.

So far as the prospects of meeting this need are concerned, every sign is encouraging. Manufacturers so far heard from are ready to co-operate. By the middle of January it is probable that as many as 50 firms, including manufacturers of parts, will be eligible as exhibitors. With respect to type of vehicle and motive power, the show would therefore be sufficiently large and diversified to give even the novice some conception of the vast field that is opening up in the nineteenth century locomotion. Capital would be favorably impressed, commercial enterprise would be turned motorward and the demand from the great purchasing public would be stimulated.

The time is ripe.

To Check Abuses in Paris.

Advices from Paris reaffirm the reports published some time since to the effect that the citizens of the French capital have lost patience with the scorching chauffeur and determined to put a stop to the nuisance, notwithstanding the social rank and wealth of the offenders. Laws will be passed compelling the police to take cognizance of the violations of the speed laws by whomsoever committed, and an effort will be made to restore the streets to their rightful owners, the public. Many riders of tricycles remove the mufflers from the exhaust in order to save weight, and this, too, has become an intolerable nuisance, converting hitherto peaceful boulevards into pandemoniums.

It is not to be wondered at, then, that the large portion of the populace of Paris that still retains its senses in the midst of the general racket and clamor, protests so loudly against these abuses that the Automobile Club has decided, for the sake of the good name of the industry, to throw its influence on the side of reason and public order, and do what it can to discourage both practices.

It can do much—in fact, it can effectually curb these rash and senseless tendencies if it chooses.

The Duplicate Part System.

The announcement that the parts of the well-known Serpollet steam vehicles will be manufactured in the United States and taken to France to be assembled illustrates again the difference in the factory systems of the two countries. The duplicate part system, which is characteristic of American manufacture and is largely responsible for our admitted superiority in this branch of industry, is but little known in France, even the most successful motor vehicle manufacturers there having a very imperfect knowledge of it. The chief owner of the Serpollet Co., who is an American, found it impossible to instil the idea into the minds of his workmen in Paris, and in order to produce the vehicles in quantities necessary to cope with the demand, he is compelled to seek the aid of American manufacturers, whose factories are all arranged and whose workmen are all trained for the rapid production of duplicate parts.

Large quantities of American machinery have been exported to France and other Contineental countries within the past few years, and reports have been current to the effect that American ideas were fast taking root in the Old World. The action of the Serpollet Co., however, tends to discredit these reports and raises the doubt whether the Americanizing of the factories of the Continent has really progressed to any great extent. Indeed, it is pertinent to inquire whether the American system ever will be generally introduced in the Old World. It is wholly foreign to its traditions, and its workmen do not take kindly to the innovation. Some suggestions of the duplicate part system are to be found in Continental factories to-day, and a good deal of American machinery, but the system as a whole cannot be successfully transplanted. To produce the same work they must have not only the tools, but the workmen.

Theory and Practice.

In mechanics as elsewhere there is constant friction between the theorist and the "practical" man; between the one who penetrates to the causes and thinks and endeavors to generalize and so improve, and the one who is cast and always remains in the mould of tradition. Both terms have been abused, it is true, the theorist being often confounded with the dreamer and the "practical" man referring to the man whose hands are much busier than his head. The latter despises theory because he does not understand it, and the former belittles practice because his theories do not square with it. Both are extremists, between whom lies the rational mind where theory and practice meet and blend harmoniously, theory invariably leading to practice because the theory is practical. Between sound theory and sound practice there can be no inseparable barrier. Many sound theories require time to develop, inasmuch as the conditions they call for cannot be immediately realized; but they are none the less true. The motor vehicle industry a few years ago was regarded as experimental or theoretical; now it is admittedly practical; but the change is not so much in the vehicle—i. e., the theory—as in the popular view of it.

Limits of the Lead Cell.

We refer our readers to an article on another page quoted from one of the highest electrical authorities in the world—the Electrical Review, of London, England—in regard to the limits of the lead storage cell. The opinions therein expressed bear out to the letter our own views on this subject, which to the uninformed may have seemed extreme. The question is one which admits of no argument. The weight and chemical analysis of lead settle it, and will continue to settle it to the end of time. Recent events prove that the electric vehicle and transportation companies of New York have discovered this truth by costly experience. They are preparing to relegate the storage battery cabs to the background and replace them by gasoline cabs on the Panhard system, reserving their electric vehicles for the luxurious use for which alone they are fitted.

This news is reassuring. It is never too late to mend.

Parks Opening.

The general tone of the press is commendatory in regard to the belated action of the New York and Philadelphia Park Boards. It is admitted that the guardians of the parks are compelled to look on both sides of the question and consider the interests of the drivers of horses as well as the drivers of automobiles. The contention raised by one member of the New York Park Board that the horses driven in the parks are as a rule of higher mettle than those encountered on the common highway, and are not so accustomed to strange sights and noises as horses which are in daily use upon the streets, is doubtless true. At any rate the automobilists, having forced in the entering wedge, should let matters rest as they are until a wider latitude can safely be allowed them.

Steam Boiler Number.

The Steam Boiler Number of The Horseless Age, which is to be issued Dec. 6 will contain not less than 50 pages, and nearly a dozen special articles on steam vehicle boilers. Supplementing these will be illustrations and descriptions of new boilers, new steam vehicles and miscellaneous matter of an interesting nature. As regards the value of its contents, the Steam Boiler Number will surpass any publication ever issued in this branch of mechanical investigation on this side of the Atlantic. Advertising copy can be received up to the morning of the 5th. Single or extra copies should be ordered in advance either of newsdealers or of The Horseless Age.

Explosive Motor Number.

We shall issue on Jan. 17 an Explosive Motor Number, dealing quite thoroughly with the fundamental principles of this valuable prime mover, and the features of it which are most important in its applacation to vehicles, viz., balancing, ignition, cooling, weight, variability of speed, etc.

This number will also be of exceptional interest, and will, we hope, clear the ground for more intelligent work in this promising branch of the motor industry.

Serpollet Steam Vehicles to be Built Here.

The New York Herald's Paris correspondence of Sunday, Nov. 26, conveys the interesting information that the Gardner-Serpollet Co., manufacturers of the well-known Serpollet steam vehicles, is so pressed with orders which it finds impossible to fill on account of the slow processes of French manufacture, that Mr. Gardner has decided to have the parts for a large number of machines turned out in America. In the published interview he says:

Automobilism is a fad of mine, and it is going to be a very lucrative also. Owing to the demand for the Gardner-Serpollet machine I have determined to manufacture a large number of them in America, and have called for tenders, and my partner, M. Serpollet, is going over to the United States very shortly to make a selection of a manufacturer to whom to confide our first order.

Now, I have the greatest respect for France and have lived here many years; but this matter has nothing to do with sentiment at all. The fact is, I do not find over here the same sort of factories as there are in America. In the United States I can order 500 automobiles at a time and have the axles, engines and all the material made all at once in a series.

This appears to me to be impossible in Paris. It seems impossible to make the workmen in my factory in the Rue Stendhal comprehend this system of running out automobiles in a series.

The duty on importing these machines (which will be brought here in parts) will be only nominal, because the law allows the importation of any new piece or pieces of machinery for a period of two years.

A Postal Official on Motor Deliveries.

The Washington representative of The Horseless Age recently called on the superintendent of the free deliveries division, Mr. A. W. Machen, to ask him what is being done with motors in the postal service.

"Yes," said Mr. Machen, "we are interested in the motor vehicle because we make it a policy to be alive to every innovation which may in any way tend to improve the service. I believe in the motor vehicle, and have encouraged experiments with it. We are going to keep on with these experiments. Detroit and Brooklyn are to have tests shortly, and manufacturers in other cities will doubtless want to have their machines tried.

"However, I am persuaded that the automobile is yet in a crude state compared with the high development it will soon reach. The department, therefore, does not contemplate any immediate purchases in this line. When we find an automobile that will run up hill and over rough roads well, that can be operated at a low cost and doesn't cost a small fortune in the first place, then will the motor vehicle surely supplant the horse in the postal service. We will gladly give the manufacturers opportunity to demonstrate their machines."

Rules for the International Races.

The rules for the contest over the Gordon-Bennett International Challenge Cup have been revised and published by the Automobile Club.

The contest is to be held between May 15 and Aug. 15 over a road course of not less than 340 and not more than 400 miles. The race will take place next year in France; but in the future it will be at the option of the defending club, either in the country to which the latter belongs or in France.

Each of the qualified clubs may enter three motor carriages weighing unoccupied, containing neither fuel, water, petroleum, batteries nor luggage of any kind, more than 880 lbs.

Throughout the race each carriage must be driven by a member of the club which has entered it and must carry one other passenger. All competitors will start at once.

The club the colors of which are carried by the winning carriage will become the defender of the cup, but in no case will the cup become the permanent property of any winner. Challenges must be sent to the defending club before January in each year, and a deposit made at the same time of the sum of $700, which will be refunded at the start. The expenses of each contest will be borne equally by all the clubs taking part in the race.

The Belgian Automobile Club has signified its intention to compete.

Wire Spoke Monopoly Broken.

A decision of interest to makers and users of motor vehicles has just been rendered by Judge Townsend in the United States Circuit Court of Connecticut in the case of the Excelsior Needle Co., of Torrington, Conn., vs. the Morse-Keefer Co., of Salisbury, both large manufacturers of wire spokes.

These spokes are made on automatic machines on the essential features of which the Excelsior Co. claimed to hold patents. This was disputed by the Morse-Keefer Co., and the Excelsior Co. brought suit to have its rights determined.

If the Excelsior Co. had succeeded in its claims to either patent it would have secured a practical monopoly of spoke making, but Judge Townsend held that the broad claims of the two patents were invalid and that the success of the Excelsior Co. had depended upon the great development of the bicycle industry.

A Word from Australia.

From Phillips, Ormonde & Co., of Melbourne, Australia, we learn that for the time being the Victorian Government has abandoned the idea of using motor mail vans. In Queensland, however, there is a strong feeling in their favor in some quarters, but the statute stands in the way of the postal authorities adopting them for the present. At Moray St., South Melbourne, Messrs. O'Farrell and Tarrant are establishing a plant for the manufacture of motor vehicles, Major O'Farrell having imported a first-class model from Germany. Harry Sutton, A. I. E. E., of Sutton Bros., is still struggling manfully and successfully, as is also one of the earliest Australian subscribers of The Horseless Age, John Pender, of Brunswick, Victoria.

Motor Farm Machinery.

The Canadian Government has been experimenting for some time with various motive powers as a propelling force for mowers, reapers and other agricultural machinery. The tests have been made at Montreal, and one of the most recent was the driving of a gang plow by a gasoline motor built by the Haynes-Apperson Co., Kokomo, Ind. It is said the motors will be attached to other farm machinery and produced in quantities.

The Automobile Show.

Owing to the large number of applicants for space to exhibit various lines of goods, the management of the Cycle and Automobile Show to be held in Madison Square Garden, New York, during the week following Jan. 20, has decided to have only bicycles and horseless vehicles on the main floor of the big amphitheater. Everything in connection with the product, such as carriage bodies, gears, wheels and bearings, will be shown at the booths of the first gallery. A number of early applicants have secured space on the main floor, but as the American Bicycle Co. ordered 104 booths it will be seen that little space remains there. The number of spaces in the entire show will be 245.

The Anglo-American Company.

It is learned from Philadelphia sources that the Anglo-American Rapid Vehicle Co., recently incorporated in Delaware with a capital of $75,000,000, proposes to pay $40,000,000 for the motor vehicle factories which it intends to purchase, offer $20,000,000 worth of stock for sale to the public and keep $15,000,000 worth (of stock) in the treasury.

The company has opened an office at 20 Broad St., New York.

Rather Curious.

In reference to the recent kite-flying in this country the editor of the Automotor says:

In the meantime another concern is in course of formation under New Jersey laws with the same objects; in this case with the modest capitalization of £40,000,000! Naturally the £40,000,000 concern has heard rumors of its £15,000,000 rival, but is not alarmed, as it will have to be brought into the larger concern. Mr. Homer W. Hedge, the secretary of the Automobile Club of America and of the Studebaker Manufacturing Co., who appears to be intimately associated with the £40,000,000 scheme, states that the company will control the manufacturers of electric, gasoline and petroleum automobiles, and that they already have practically the control of all the parts of vehicles except the specialties of the Goodrich Co. and Mr. Eleazer Kempshall's (Boston) company. As Mr. Kempshall, however, is, at the time of writing, according to the New York Herald (Paris), at the Waldorf-Astoria Hotel, New York, with Mr. Hedge, it looks as if the latter's statement that these two concerns would, without doubt, be brought into the combination is in course of being confirmed. It strikes us, however, as being curious that such a prominent part in company promotion should be taken by the secretary of the Automobile Club of America. When the club was in course of formation great stress, we think, was laid, among other things, upon the policy of the club to keep clear of all company promoting complications. It is early days for such a falling away.

MINOR MENTION.

The Columbia & Electric Vehicle Co., Hartford, Conn., is said to have acquired the plant of the Hartford Cycle Co. for the manufacture of electric vehicles.

A consolidation of vehicle spring and axle manufacturers is said to be nearly completed. The capital will be $6,000,000, with $6,500,000 in bonds, but no preferred stock.

The laboratory at Newton Lower Falls, Mass., until recently occupied by Billings, Clapp & Co., manufacturing chemists, has been leased for the manufacture of automobiles.

Edward L. Fuller, of Scranton, Pa., is said to be endeavoring to organize a company to manufacture the Post "capsule" electric storage battery and "put a line of public cabs in competition with those now in New York."

Dr. Geo. M. Calmus, 2845 K St., San Diego, Cal., has been investigating the motor vehicle industry in the East, preparatory to organizing the California Automobile Co. in that city. He has constructed a rotary engine weighing but 15 lbs., which he states will develop 5 h.p., and which the company proposes to use as motive power on the vehicles of its manufacture.

Two New Jersey corporations recently reported are the United States Auto Motor Co., capital $1,000,000, to operate compressed air boats and vehicles; incorporators, Charles A. Troll, Louis J. Frey and F. W. Hotchkiss, all of Jersey City, and the Howard Automobile Co., Trenton, N. J., capital stock $200,000, to manufacture automobiles under the patents of W. L. Howard.

LONDON NOTES.

London, Nov. 17.

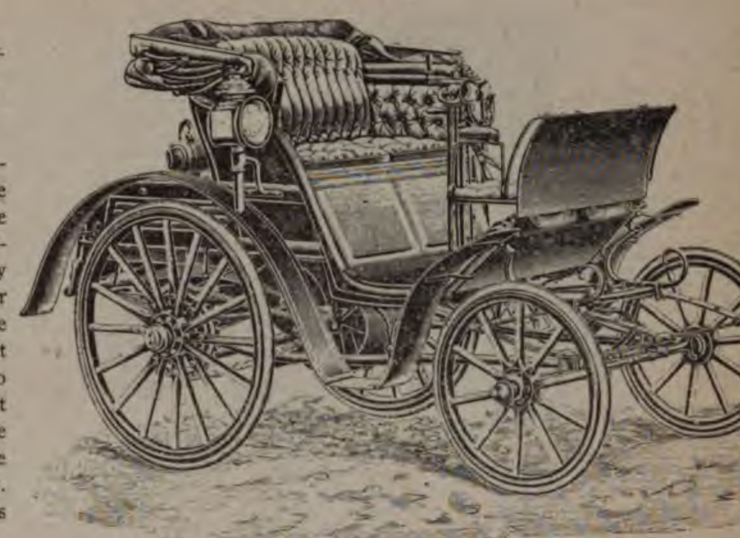
MOTOR VANS WANTED BY THE CHELSEA VESTRY.

I have previously mentioned the fact that the Chelsea Vestry had decided to give motor traction a trial, and that three motor vehicles were to be acquired. I have just obtained the specifications of the desired vehicles, according to which the extreme width of the vehicles is not to exceed 6 ft. 6 in., and they are to be of sufficient capacity to carry 6 cu. yds. of sand or other material of a weight not exceeding 4 tons. The vans will be required to carry a load up an incline of 1 in 20 for 100 yds. at a speed of 4 miles an hour, and makers are not restricted to any kind of motive power. They must guarantee that the cost of working shall not exceed a certain sum per mile, to be named in the tender, and also have the vans driven for one week after being delivered without expense to the vestry. Bids have to be sent in by the 21st. inst. to the Vestry Clerk's office, Town Hall, Chelsea, London, S. W.

THE BENZ RACING CARRIAGE.

It is only recently that Benz & Co., of Mannheim, Germany, took up the construction of special racing carriages, and their first vehicle achieved the success of winning the first prize in the Berlin-Leipsig race organized by the Mid-European Motor Car Clubs. It is fitted with a two-cylinder horizontal motor of 14 h.p. The power is transmatted to the countershaft by belts working on fast and loose pulleys; four forward speeds are provided, as also a reverse motion. The wheels are of wood, shod with pneumatic tires. Special attention has been paid to the cylinder cooling arrangement. In addition to the ordinary condenser behind the seat, a special cooling device is provided near the front axle, which, it is claimed, enables a run of 1,000 miles to be made without changing the water. As to speed, the makers claim that the carriage can attain a maximum of from 34 to 37 miles an hour on level roads, and that it can mount any gradient. The cost of the carriage is $3,750.

BENZ RACING CARRIAGE.



THE BENZ DUC.

1900 MODELS.

"1900 models" are already beginning to make their appearance. One of the first is that of Benz & Co., of Mannheim, Germany, of which I send you an illustration herewith. The carriage, which is known as the "Duc," is rather larger than their well-known "Ideal," which will, however, still be made. The new vehicle is 5 ft. 3 in. wide and is arranged to comfortably seat three or four persons. The motive power is supplied by a 5 h.p. single-cylinder engine, with electric ignition and water jacket. A new departure is the provision of a water cooler in addition to the ordinary condenser, by means of which frequent change of the cylinder-cooling water is rendered unnecessary. The power is transmitted by belts working on fast and loose pulleys, there being three forward speeds and one reverse. Another new departure is the adoption of wooden wheels, with solid rubber tires in place of the wire wheels used in the "Ideal" carriage.

Quite a number of the leading electrical engineering firms in Germany and Belgium are devoting attention to electric motor vehicles. The latest concern is the Société Electricité et Hydraulique, of Charleroi, Belgium. This company has just issued its report for the financial year 1898-99, and in it it is stated that the designs of new electrical vehicles are well in hand, and that workshops for the construction of the same will shortly be established.

MORE RACING VEHICLES.

The Motor Vehicle Co., of Regent St., London, W., a new company formed to build motor vehicles fitted with the Napier Gasoline motor, illustrated in The Horseless Age for July 19 last, are at present engaged on the construction of three very high power cars, two of which at least will be driven in the big French races during the coming season and probably compete for the Gordon Bennett challenge cup. The carriages in question will be fitted with a four-cylinder motor of 16 h.p. Special attention is being devoted to the water cooling and lubricating arangements, the object being to supply a car of ample horse-power to climb steep gradients at a good speed and at the same time to have all parts made sufficiently strong to run for many thousands of miles without requiring readjustment or mechanical attention in the workshop.

AN ENGLISH ODDITY.

A CONFIRMED SKEPTIC.

Since the failure attending its automobile competition some three or four years ago that old-established journal, the Engineer, has taken a very skeptical attitude toward motor vehicles, and in a recent issue made the statement that there are probably not more than 200 motor vehicles running in the United Kingdom. That this statement is far from true the secretary of the Automobile Club has taken some trouble to prove, and in a letter sent out this week he shows that up to the end of September last the Daimler Motor Co., Ltd., supplied over 300 motors, while Hewetsons, the British agents for the Benz carriages, had up to the same period sold over 500 of these vehicles in England.

MORE AUTOMOBILE CLUBS.

A meeting has just been held at the Bell Hotel, Humberstone Gate, Leicester, to consider how the iterests of the motor carriage in that district could be protected and widened. Ultimately it was decided to form a Leicester and County Automobile Club. I also learn that the formation of a Scottish branch of the Automobile Club has been practically decided upon, and that a meeting is to be held in Glasgow on the 30th inst. to inaugurate the same. The necessary steps have been taken to form a Manchester branch of the Automobile Club, and the inaugural meeting will be held in that city on the 22d inst.

NEW VARIABLE SPEED GEAR.

An exhibition has been given this week at the engineering works of P. Hooker, Farringdon Road, London, E. C., of a new variable speed gear devised by W. H. Newman, of Totteridge Park, Herts. The device is intended to be fitted on an intermediary shaft. It is not a change speed gear in the sense that certain pairs of wheels are disengaged while another pair is brought into gear. It comprises a box containing three pinions, all in gear, with a small pinion mounted on the end of the hollow shaft carrying the driven pulley.

Fig. 1 shows the complete apparatus and Fig. 2 the various parts. The shaft A is driven by the motor, and the speed of the shaft B, which is connected to the machinery to be driven, can be varied at will by means of the hand wheel. In the position shown B is at rest, but as the hand wheel is screwed in, B will be graudally put in motion and will be at its maximum speed when the hand wheel is right in. The shaft A has a ball bearing eccentric on the end of it, which is connected to the three clutches contained in the three gear wheels, and by varying the throw of the eccentric, by means of the hand wheel, the speed of B is varied.

The three pinions are all mounted very much on the lines of the free wheels at present being used on bicycles—i. e., with roller clutches working on inclined planes. The three pinions, although running free, are all continuously in gear with the driven pinion, the clutches being brought into action, one after the other, without interval, as the controlling hand wheel and screw gear is advanced. With the driving shaft running at 650 revolutions per minute the driven shaft can be varied in speed from 0 to about 500 revolutions per minute, the apparatus being capable of transmitting about 3 h.p. at that speed. The gear occupies but very little space, and judging from a cursory examination appears to work very quietly. For horseless vehicle purposes the clutches would be controlled by a hand lever, so that all of them and consequently the driven pulley or pinion could be instantly put out of gear in case of necessity.

A new firm to take up the manufacture of motor vehicles in England is J. Grose, of Northampton, who is well known in the cycle trade as a maker of gear cases. No claim for originality is made for the new carriage, which is to all intents and purposes a copy of the popular Benz. The feature, however, lies in the attention given to the construction of the various parts, bearings, etc., with the view of increasing the durability of the vehicle.

The latest addition to the list of motor vehicle chain makers is the Birmingham Small Arms Co., Ltd, of Birmingham, who have just introduced a roller chain 9-16 in. wide by 1½ in. pitch. The breaking strain of the new chain is given as 4½ tons.

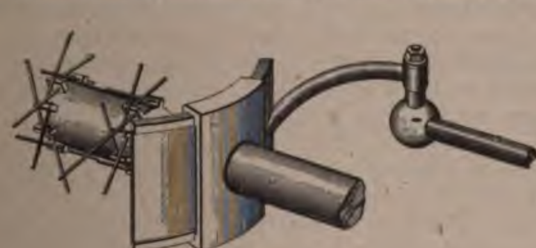
VARIABLE SPEED GEAR.

The Jamieson Steering Device.

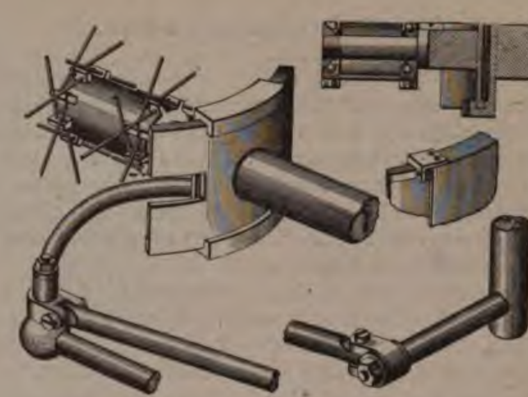
Steering devices are of the utmost interest to motor vehicle constructors. One of the most novel of these, invented and patented by Robert W. Jamieson, of Rochester, N. Y., is illustrated here. Fig. 1 represents the preferred construction

STEERING DEVICE ON CARRIAGE.

as now used in a steam automobile. Fig. 2 is another possible construction, and Fig. 3 illustrates a means for keeping the slideways clean through the agency of a piece of felt, marked X. The advantages of this steering connection, as claimed by the inventor, are, first, it permits the wheels to turn on vertical centers and is extremely simple, being composed of two



parts only; second, it has the advantage of not only turning the wheels upon their vertical centers, but is a self-locking device as well, for when the wheels encounter obstructions head on, the tendency of the short stud axles upon which the wheels are mounted is to turn about their connections, but by being engaged in the fixed arc bearings (which can be readily understood by referring to drawings), the action of the steering lever, commonly expressed as jiggering, and the whipping of the lever from the hand are said to be entirely



overcome. For a more detailed description readers are referred to the patent issued the 14th inst.

The patent contains seventeen broad claims, of which the inventor believes the fifteenth, sixteenth and seventeenth are the best.

Claim 15.—The combination with a support of the wheels, the stud axles on which the wheels are mounted and guiding and supporting mechanism between the stud axles and supports for entirely supporting the wheels located exteriorly of the wheel hubs, and guiding the stud axles to turn in substantially horizontal planes on circles struck from centers within the wheel hubs.

STEAM CARRIAGE OF R. W. JAMIESON.

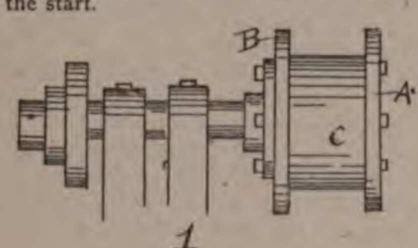
The photograph of the steam vehicle shows the steering connections in actual operation. The patent also covers anti-friction devices which can be used in this connection if necessary when heavy weights are to be carried.

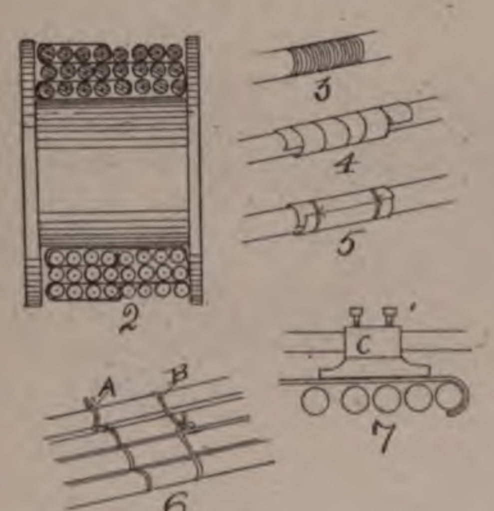
A movement is on foot in Budapest, Hungary, to start a service of motor omnibuses. Between Friedrichshafen and Ravensburg, Germany, a service of electric omnibuses has already been inaugurated.

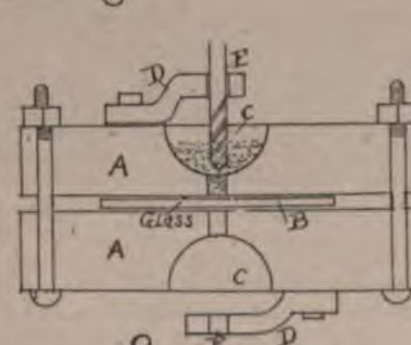
Electric Motor Coils.

In Fig. 1 is a sketch of a method of winding a mummified coil. The form (c) is a wood cylinder, tapering very slightly toward the outside flange. The flanges (A) and (B) are iron, and are drilled for clamping to the face plate of a lathe. If the holes are bored to correspond with those in the face plate, one set of bolts will do for the form. After winding, the nuts are removed and the flange (A) slipped off. The coil can then be removed.

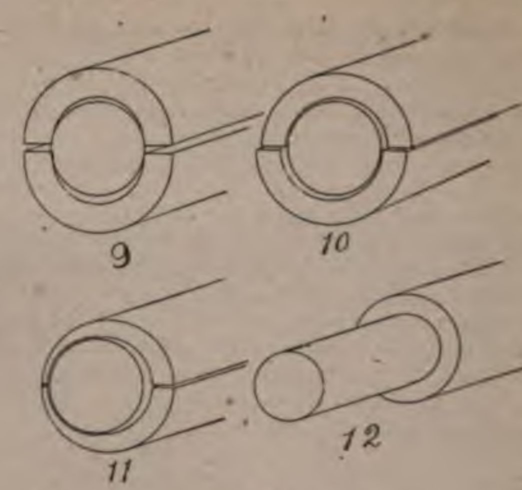
The method of insulating is explained in the sectional drawing Fig. 2. The tape is wound in the intervals shown. To do this strong strip tape is used, and after its adjustment over four wires it is brought up between the coils and lapped over the next four turns. Then the tape is brought over all the next layers, and so on to the last, where it is alternated as at the start.

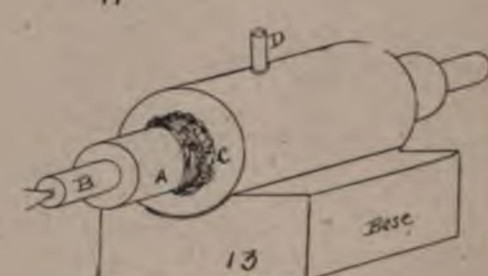


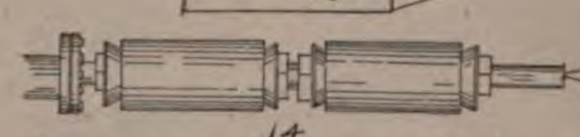




It is quite essential to go slow in winding and locate every defect in the insulation. It is not uncommon to find several breaks in the insulation which require fixing. One good method, shown in Fig. 3, consists in winding cotton yarn over the fracture. Another method is to wind the break with







varnished cloth or paper, as in Fig. 4. Still another mode is to wrap some fabrical material about the wound and fasten this with cords about each end, as in Fig. 5.

Two plans for securing the last turn are shown in Fig. 6. The first is marked (A) and is accomplished by putting the cord around several times and knotting it. The other method, shown at (B), requires that the cord be passed around several times without encircling each wire. The ends are knotted as shown.

A terminal of the description shown at (c), Fig. 7, is used for the end field coil. This is cast from brass or similar metal and bored out for the end and provided with two set screws.

The plan used for drilling holes of small diameter in the glass disks is shown in Fig. 8. Two iron pieces (A) (A) are cut out square, about ¾ inch thick, and bored at the edges for clamping bolts. Little reservoirs are sunk at (C) (C) to contain oil and emery. The bottoms are drilled to receive the boring tool. The bent pieces (D) (D) are forged out, drilled at (E) (E) for the boring tool and set-screwed to the plates as shown. The glass disk (B) is clamped in the position shown, with layers of rubber or leather between the iron and the glass. The device is placed on blocks and drilling begun with a common boring tool. After cutting part way into the glass, the device is turned over, emery and oil are placed in the other reservoir (C) and the hole finished from that side.

BEARINGS.

The problem of reducing delays due to the hot boxes is one which must not be overlooked. I have seen some journal sleeves in service as badly fitted as those in Fig. 9. The shaft is too small for the sleeves, and, of course, the lubricating oil films cannot properly form and the box heats. This defect

was fixed by removing the sleeves and turning them out large enough to fit the shaft right. In another motor which recently came to the shop one of the bearings was found in the condition of Fig. 10. The edges of the sleeves did not meet correctly. The projections thus formed scraped off the oil films and caused defective lubrication, grinding and heating. A proper aligning of the sleeves fixed this. Worn sleeves, due to improper setting, are also common, as in Fig. 11, showing a box in which the sleeves are ready for removal. In case new sleeves are not at hand, rebabbitt the old ones as in Fig. 13, by fixing up a suitable core (A), which should be of the same size as the shaft. Then the sleeves are adjusted in a base and the ends closed with twine and clay or putty. The new metal is poured into the oil hole at (D). If a shaft is cut and worn, as in Fig. 12, turn down the end in a lathe and make practically a new surface. Independent sleeves can be trued easily on the form in Fig. 14. One sleeve is the guide sleeve from which to take measurements and the other is the worn sleeve. A steel shaft is prepared for attachment to a face plate (C) in a lathe and four cones are provided. These cones are held in place and adjusted by means of nuts which work on threads cut on the steel shaft. The manner of using the cones to sustain the sleeves in the centre is shown.

MAKING A WIRE CYLINDER.

A good way to make a wire cylinder for shop use is as follows: The covering is purchased at makers of card wire for textile machinery, and in clothing a new cylinder great care should be taken in winding the clothing on the drum connected with the stretcher, so as not to cripple any of the teeth, as every tooth must stand properly in its place. After seeing that the shaft of the roller is perfectly true and the wood cylinder turned off, holes plugged, etc., we should cover the wood with a coating of oil, that will have a tendency to keep the leather soft and flexible, and give a springiness to the wire, which is more desirable than stiffness. Wind on the clothing with just enough tension to prevent "running" while grinding. After the roll is covered, see to it that every tooth is in its proper place, and then place in a grinding frame, running the roll slowly. A traverse grinder is, in my opinion, preferable to the old style of emery roll. Set it up to the grinder, not too hard, and let it run. The length of time necessary to grind will depend on the condition of the wire and the cutting qualities of the emery on the grinder. Let it grind until it is perfectly smooth and even and all those dark streaks have disappeared, which can easily be seen by standing out a little distance and looking along the surface of the wire lengthwise.

Panhard-Levassor Patents Secured by The Daimler Mfg Co.

The Daimler Mfg. Co., Steinway, L. I., have secured the American rights under the Panhard-Levassor patents, and will manufacture Daimler and Daimler-Phenix motors and vehicles under the well-known Daimler and Panhard-Levassor systems, including gasoline cabs, which will be operated in New York and other cities in connection with the electric cabs of the Electric Vehicle Co. and their allied transportation companies. The Daimler Co. announce that they will have their carriage catalogue ready about Feb. 1 and be ready to accept orders about Feb. 15.

Electric Transportation Changes.

The New York Electric Vehicle Transportation Co. will establish stations for their electric cabs in different parts of the city in order to decrease the mileage required of the cabs and provide convenient recharging stations. The present station at 1684 Broadway is to be converted into a general supply and repair shop.

The company also announce that gasoline cabs on the Panhard-Levassor system are being built for them by the Daimler Mfg. Co., of Steinway, L. I., and will be put in service soon.

Herbert M. Lloyd in a recent interview outlined other changes. He said:

An arrangement has been effected by which the Electric Vehicle Co. got control of the business of the Pope Mfg. Co. in Europe. This arrangement includes a working agreement with Ludwig Loewe & Co., of Berlin, for Germany and Austria, by which the Electric Vehicle Co. will get a handsome royalty on all the gross business in automobiles of this firm. They will use our designs to some extent.

In France we are now starting a transportation company on the same lines as those followed in organizing in this country. This company, which is known as "l'Electromotion," is licensed by the Electric Vehicle Co. In addition to this company the Electric Vehicle Co. will open general offices in Paris, Hart O. Berg, formerly with the Pope Mfg. Co., being general manager.

We also propose to start a transportation company in England, Russia and other European countries. In England there is a great demand for automobiles and practically no supply of first-class vehicles. In France and Germany, of course, the business has reached considerable proportions. We find, however, that there is little system in the business and that there is a good chance for the introduction of American ideas.

The Electric Vehicle Co. will have an elaborate exhibit at the coming World's Fair at Paris, the intention being to make its display the most complete of any.

The Hasbrouck Motors and Vehicles.

The Hasbrouck Motor Co., 68 Broad St., New York, are now placing on the market gasoline motors for marine, vehicle and stationary uses in sizes of 2, 4, 6, 8 and 10 h.p., other sizes to order.

The Hasbrouck motor patents were fully described in our issue of May 17, 1899. It is described by the makers as having no air valves, as compact, balanced, noiseless, simple and odorless, a white handkerchief held against the exhaust showing no sign of soot or odor when it is removed.

At present the company are building two styles of automobiles, a runabout and a surrey, speeded to as high as 20 miles and capable of climbing a 20 per cent. grade. They also build other styles, including delivery wagons, to order.

The Hasbrouck launches are built in lengths varrying from 25 to 50 ft.

A compressed air "auto-truck" was landed in New York last Sunday from the Providence steamer and taken to the charging station of the Metropolitan Street Railway Co. at the foot of Twenty-fourth St., North River. It was built at the works of the International Power Co., Providence, R. I.

OUR FOREIGN EXCHANGES.

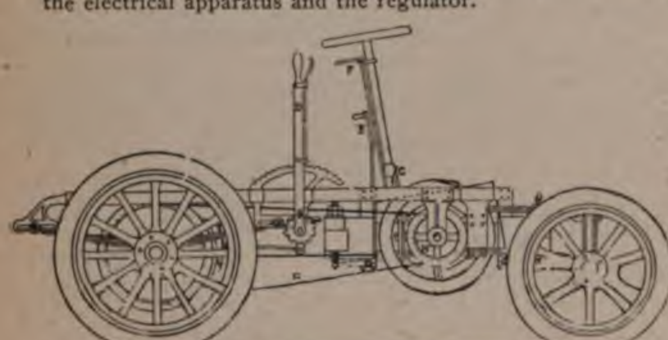
The New Vallee Carriage.

This new carriage, which took part in the race from Paris to St. Malo, made 370 kilometers in 8 hours 51 minutes, and the 322 kilometers from Paris to Ostend in 7 hours 47 minutes, or about 25 miles an hour.

Here is the description:

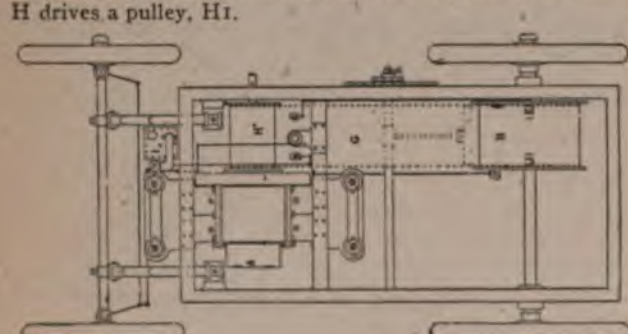
The motor is of the four-cycle type and has four equal cylinders. Situated in the forward part, they do not disturb the carriage.

The case A contains the cams which control the exhaust, the electrical apparatus and the regulator.



The carbureter I is also placed in front. On the pipe leading to the motor is placed the mixture valve, controlled by the handle F, and the stop valve of the motor. This last has two controlling connections, one coming from the regulator and the other from the pedal B. The regulator is but for the purpose of maintaining the motor at a normal speed when on streets or when the carriage has a free field.

For crossing towns, slow movements, manœuvring, or on down grades, the pedal B closes the motor, which then acts as a brake and permits traveling as slow as one could desire. H drives a pulley, H1.



The rear axle turns with the driving wheels; it carries a drum, H, which retains in K the differential gear and in I the backing motion controlled by the handle E; in K is found also the brake C, acting on the interior by expansion.

The transmission works directly from the motor to the axle by a very large belt, G, traveling on the pulleys H1 and H, the necessary tension being obtained by means of the lever D.

The belt obviates entirely chains and gears. It constitutes the easiest and the most silent transmission that any one could wish.

Independently of the motor, which constitutes the best brake, the carriage possesses two very powerful brakes, the one controlled by the pedal C acting on the inside of the drum H by a strong steel band shod with brass. The other is a shoe, L, controlled by the lever D acting on the outside of the drum H when the driving belt is slackened.

The carriage which has the best speed-changing device is perhaps the best of any. To attain this end two things are necessary: First—Strength to climb hills. Second—Facility in slow motion.

By constructing a four-cylinder motor this double result is attained at a single stroke.

The carriage mounts easily at 30 kilometers per hour hills previously climbed at 15 kilometers with a two-cylinder motor. For slow speeds the four cylinders render the motor as tractable as a steam engine. So easy is the movement that when controlled by the pedal B the motor assumes a gait corresponding to no more than fifty rotations to the minute. One has also the power of going slowly by releasing the tension on the belt by the lever D.

The advantages of this type of carriage can be summed up as follows Extreme simplicity in construction; discarding handles and levers for changing speeds; the silent action by reason of the absence of chains and gears.—De Sarcy in La Locomotion Automobile.

The "Abeille" Motor.

This is an Otto cycle, single-cylinder, vertical motor of 3 h.p. built by A. de Mesmay, says La France Automobile, and employed by Dalifol & Thomas on their light carriages.

The method of cooling is described as the mixed, obtaining the full force of the motor without overheating. The water is circulated by a small centrifugal pump situated on the case and operated by a belt on the motor shaft.

The placing of the valves on each side of the explosion chamber is said to facilitate the escape of the burnt gases and the entrance of the fresh mixture, the current always tending in the same direction. Moreover, by placing the ignition plug very close to the admission valve the spark is produced in the very center of the fresh mixture, and the plug is protected from the oil of the cylinder. Another advantage in this arrangement of the valves is ease of access without interfering with any of the pipes.

All the mechanism is located in a case rigidly attached to the base. Within this are the gears, the exhaust and ignition cams. Upon the axis of the latter is pivoted a movable piece regulating the time of the spark.

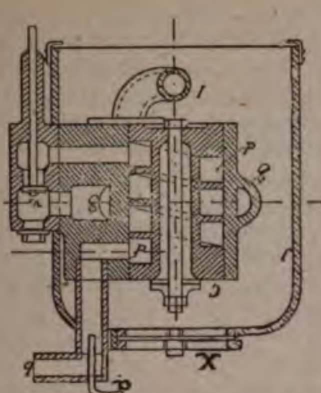
The carbureter, attached to the motor itself, is very simple and is governed in two ways, first to obtain a satisfactory mixture, second to vary the quantity of this mixture admitted to the cylinder.

This motor, easily attached to any vehicle, weighs about 100 lbs.

Carburateur-Vaporisateur Barnes.

In the arrangement, patented by M. Barnes and described in La Locomotion Automobile, the oil, introduced by the tube a, meets the air current passing through the pipe b; the mixture is perfected in the spiral groove d d of the piece C, then by way of g to supply the admission valve of the motor, above which is received the necessary amount of pure air to form an explosive mixture.

Ignition is made by the copper tube I, which communicates with the valve V¹, and is kept red by the heat of the explosions. The heat of the casting C vaporizes the oil.



When getting ready for work the piece C is heated by a lamp; the temperature of C can be regulated by a current of air passing through X and circulating in the shell J.

The Storage Battery for Vehicles.

So much money has been and is being expended in developing storage battery patents that some authoritative remarks on the subject of storage cells may be useful both to capitalists and inventors. We reproduce the following article from a recent issue of the Electrical Review (with the permission of the editors of that journal), as we think it may be read with advantage by all interested in electromobiles:

"The motor car movement has greatly stimulated the efforts of inventors to produce a storage battery of great capacity per unit of weight, and not a few batteries have been put on the market professing to be of much less weight for equal output than the older forms. An examination of these new batteries and of the specifications reveals the fact that the inventors have not succeeded in making any departure from the essentials of the Faure and Planté cells, lead and lead salts alone being successfully used. The plates consist of lead salts held in or upon a lead grid or electrode.

"In stationary batteries there are no objections to constructing the grids substantially enough to perform the two functions of supporting the active materials and collecting the current therefrom, thus producing cells of considerable weight, six or seven watt-hours per pound. weight of battery being a fair result in capacity. Such batteries are well understood and are durable and reliable; but for successful traction work batteries of such weight are not suitable.

"Most inventors endeavor to reduce the weight by increasing the proportion of lead salts to the weight of the grid; in heavy batteries we may find the lead grid equal to twice the weight of lead salts used in making up the plates, while in some recent cells we find it claimed that the grid is only half the weight of the salts.

"So long as lead is used in batteries, the only invention possible is in the direction of reducing the mass of lead in the cell, sufficient being left simply to collect the current. The supporting of the active materials being no longer trusted to the grid, the inventor then devised supports of ebonite, glass, acid-proof paper and other materials, much lighter than lead, which are applied in two different ways.

"One uses a grid of vertical lead wires threaded through horizontal strips of ebonite, forming shelves, which carry the active materials and support them. Another takes glass rods as a welt interwoven with lead wires, the glass giving stiffness and resilience to the plates. A third employs very light perforated grids, and supports them by plates of light acid-proof paper, also perforated. Others prefer envelopes of celluloid or ebonite to hold the paste on extremely thin grids.

"In all this there is not much invention. Still, if by some means a battery of great capacity and small weight can be produced, it is worthy of a patent.

"It is claimed for some of these cells that 15 to 16 watt-hours per pound of battery, at a discharge rate of 1 ampere per pound of battery, has been obtained. We have failed, however, to find any independent confirmation of a capacity in any battery exceeding 10 to 11 watt-hours per pound. We are convinced that all these high capacity light weight cells will require very frequent renewal of plates; the negatives rapidly decline in capacity in continuous work and the positive grids soon corrode right through, the internal resistance increasing as these changes go on.

"The renewal of cheap plates as soon as the capacity falls below a certain amount should be provided for in all battery traction projects, renewals forming a large part of the cost of battery traction. Plates which were expensive to renew would be no improvement over cheap plates of the same capacity.

"In judging traction batteries it is not, therefore, sufficient to find the capacity per pound weight only. It is necessary to find how long that capacity is maintained in continuous working. Say a battery starts with a capacity of 12 watt-hours per pound, how many full charges and discharges will it stand before the capacity falls to 10 watt-hours per pound, and what will be the cost of renewal? These questions are rarely answered in descriptions of new cells.

"In connection with road traction by batteries, we find that most vehicles for that purpose carry 80-volt batteries. Why 80 volts? We have never been able to find out the reason for this singular voltage; why not use larger cells and fewer of them?

"The battery is so near the motor that loss in the leads is negligible. As only 100 to 120 volt circuits can be used for charging 80-volt batteries, probably 80 volts was selected in the days when 110 volts was the usual pressure; but nowadays 200 to 250 is becoming so common that batteries to be used on supply from street mains must be raised to 160, 180 or 200 volts pressure, although small cells do not give quite as high a capacity per pound as larger ones.

"On the whole, inventors have not much room for improvements in lead cells. When they have reduced the grid to a minimum, and supported the active materials by something lighter than lead, their efforts are exhausted, and a possible capacity of about 14 watt-hours per pound is obtained for a time."—The Automotor.

QUESTIONS AND ANSWERS.

At the request of many of our readers we have decided to open a department of questions and answers. We will endeavor to answer any detail question in practical engineering pertaining to motor vehicles.

Wants Castings and Drawings.

Stamford, Conn., Nov. 20.

Editor Horseless Age:

Can you tell me if the Stanley people have their motive power patented? If so, what is the number of the patent? Do you know where I could buy a set of castings in the rough suitable for a small carriage or where I could get the drawings for one?

CLINTON WORDEN.

1. Application doubtless made, but, so far as we are aware, no patent yet issued.

2. We cannot supply the information sought.

MOTOR VEHICLE PATENTS

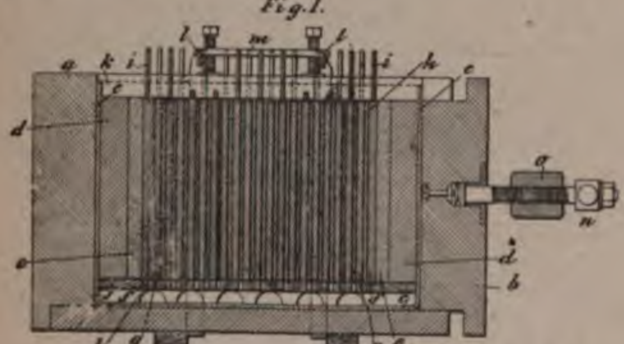
of the world

UNITED STATES PATENTS.

No. 637,625—Apparatus for Forming Plates for Secondary Batteries.—Henry Leitner, London, England. Filed June 12, 1899. Serial No. 720,244. (No model.)

The invention relates to an apparatus for forming plates or electrodes of secondary batteries so arranged that the expansive force of the active material during its change into peroxide is utilized for subjecting the plates to great pressure while they are being formed.

Fig. 1.



During the process of formation, while the paste of the positive plates is being converted into peroxide, the plates tend to expand to a considerable extent, and owing to the rigid confinement at the sides and top and bottom this expansion can only be in thickness, as allowed by the elastic pads e. The active material of the plates is thus compressed and rendered close and hard. The pressure, if excessive, can be relieved by a turn of the screw n. During discharge the pressure on the plates is maintained by the resiliency of the pads e. The active material is thus not only rendered hard and homogeneous, but is also kept tightly against the conducting grid of the plate, insuring perfect contact.

No. 637,477—Variable Speed Gear.—William H. Newman, Totteridge Park, England. Filed July 3, 1899. Serial No. 722,670. (No model.)

Claim.—The combination of a driving shaft, a driven shaft, ratchet wheels arranged at equal angles around the driven shaft, toothed wheels coaxial with the ratchet wheels and driven by them in one direction by pawls, a toothed wheel fixed to the driven shaft and gearing with the other wheels, an eccentric on the driving shaft, a second eccentric surrounding the first, a ring on the second eccentric, connections between the ring and the ratchet wheels, and means for rotating the two eccentrics relatively to each other.

No. 637,127—Controlling Mechanism for Vehicles.—Ernest A. V. Kendall, Hartford, Conn. Filed Feb. 25, 1899. Serial No. 706,771. (No model.)

No. 637,062—Carbureter.—Bernhard C. J. Anderson, Morton Park, Ill., assignor of one-half to L. F. Nonnast, Chicago, Ill. Filed Nov. 21, 1898. Serial No. 697,036. (No model.)

No. 637,665—Motor Vehicle.—George F. Reed, Waldo, Fla. Filed Aug. 2, 1899. Serial No. 725,884.

This invention relates to an apparatus designed especially for hauling logs and like material; and embodies, in connection with the gearing for propelling the vehicle, a power-driven means for raising the logs or other material constituting the load in position to be transported.

No. 637,661—Compression of Air and Utilization Thereof.—Edward E. Pettee and John McCutchan, New York, N. Y. Original application filed March 9, 1899. Serial No. 708,421. Divided and this application filed Oct. 24, 1899. Serial No. 734,615. (No model.)

This relates to apparatus for carrying out the methods described in No. 637,659.

No. 637,296.—Running Gear for Vehicles.—George S. Strong, New York, assignor to John P. Murphy, Philadelphia, Pa.

Figure 1 is a plan view of my improved running gear, showing the motor supported thereon and the operative connections between the motor and the rear or driving axle of the vehicle.

FIG. 1.

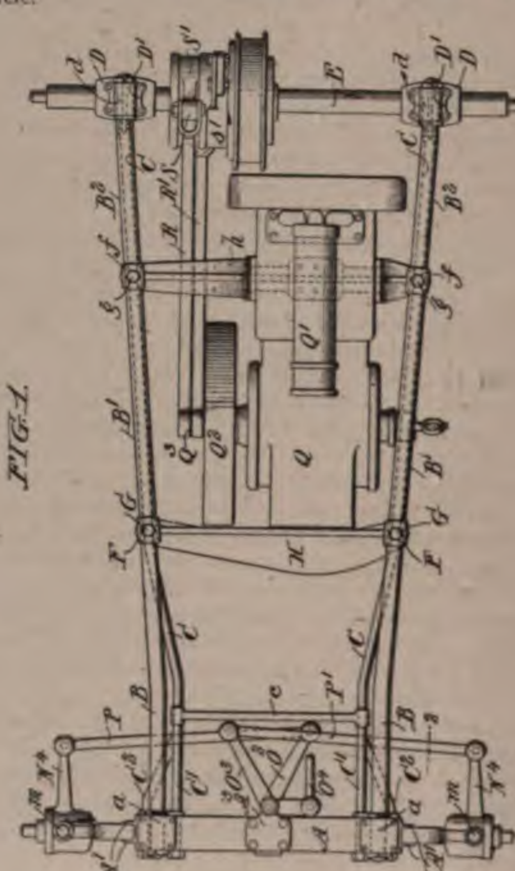
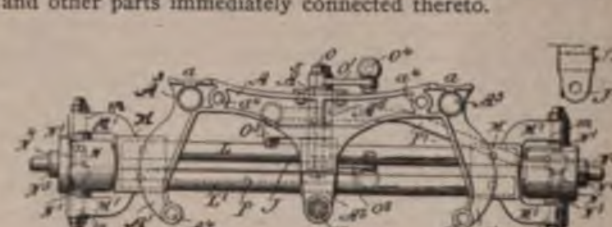


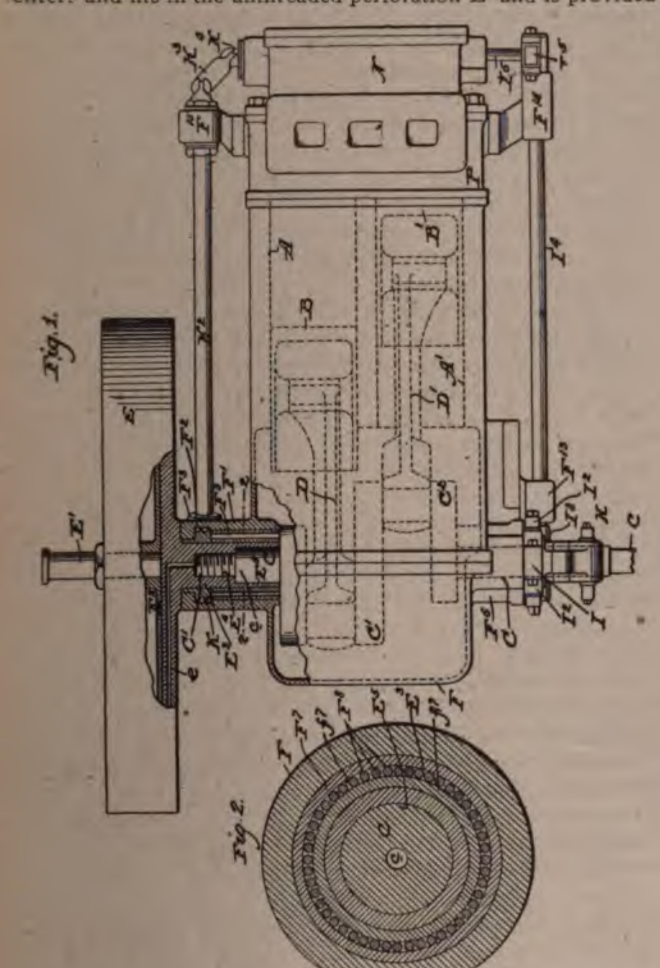
Fig. 6 is a front view of the said front bolster, the axle bar and other parts immediately connected thereto.



Claim.—A running gear framing for automobile vehicles having in combination a front bolster and two rear axle boxes, as D D, truss compression members, as B, connecting the top of the bolster with the upper ends of the boxes D, truss tension members, C, connected to the boxes D below the members B and formed with forked front ends, C' C^2, one fork connecting with the top of the bolster and the other with its lower side of extension, and strut rods, G g, extending between the compression and tension members of the truss.

No. 637,300—Crank Shaft.—George S. Strong, New York, N. Y., assignor to John P. Murphy, Philadelphia, Pa. Original application filed Dec. 15, 1898. Serial No. 699,312. Divided and this application filed May 5, 1899. Serial No. 715,-695. (No model.)

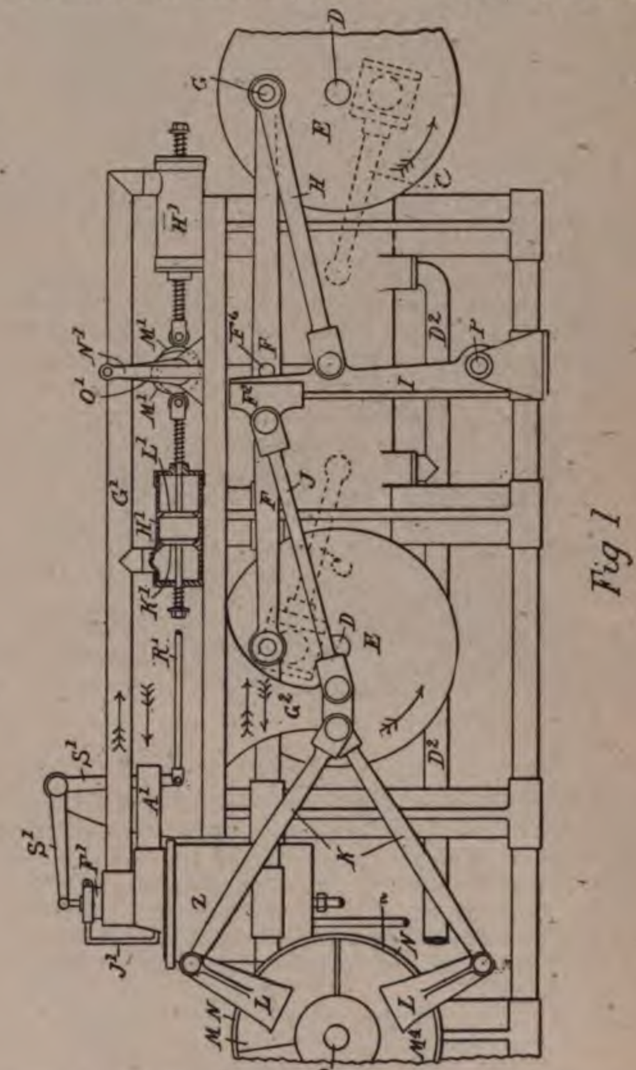
The fly wheel E is formed with a centrally projecting stud shaft, E^3, having near the wheel a threaded perforation, E^4, which near the outer side of the stud shaft opens into an enlarged unthreaded perforation, E^5. The end of the shaft C enters and fits in the unthreaded perforation E^5 and is provided



with a threaded extension, C', of smaller diameter, which screws into the threaded perforation E^4, thus securing the shaft and the stud shaft of the fly wheel together. The bearing F' surrounds the stud shaft E^3 and forms directly a bearing for this stud shaft and only indirectly a bearing for the shaft C, and in this way the weight of the fly wheel is carried directly on the bearing instead of making the bearing act directly on the shaft and carrying the weight of the fly wheel on the shaft.

No. 637,658—Motor Vehicle.—John Pender, Brunswick, Victoria. Filed March 15, 1898. Serial No. 673,961. (No model.)

The invention consists of two crank shafts, between which are two cylinders, both ends of which are open. In each of these cylinders are two pistons, expelled by the same explosion occurring at each revolution. These pistons by connecting rods are coupled to opposite cranks in such a way that they drive them in the same direction. From disks at the end of one of the crank shafts a reciprocatory motion is conveyed by connecting rods to a vertical rocking lever pivoted at its bottom. Up and down this lever adjustably slides (thus providing a variable transmission gear) one end of a connecting rod, the other end of which is pivoted to a horizontally moving



slide. To this slide are pivoted two connecting rods ,the other ends of which are connected to pins on arms protruding from cheeks moving within a clutch box on the main or rear wheel driving shaft. Though these connecting rods have a reciprocatory motion, they transfer a rotary one to the driving shaft in the manner hereinafter described. The air charge for the explosions is drawn by a double-acting air pump (situated between the two cylinders and operated by a crank on one of the crank shafts) through a carbureter. It then passes through

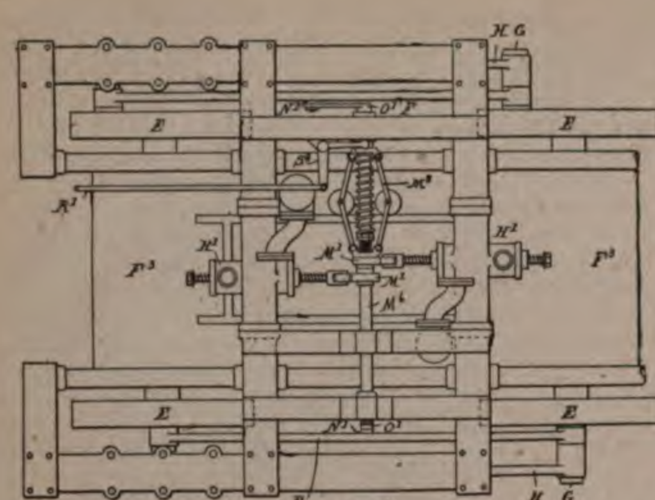


Fig 3

valves regulated by a cam above the cylinders and enters each cylinder alternately after the pistons have covered the exhaust port on their inward stroke. It is then compressed by the ingoing pistons and ignited.

Fig. 1 represents a side elevation of one of the motor cylinders, showing in dotted lines the two connecting rods, which are operated by the two pistons, likewise the clutch box and mechanism by which a reciprocatory motion is transformed

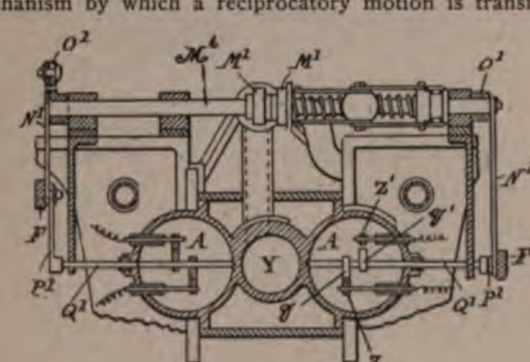


Fig 4

into a rotary motion. Fig. 3 also represents a plan showing the governor gear. Fig. 4 represents an end elevation, partly in section, showing the electric igniting devices and the rotating shafts by which the circuits are completed and broken. Fig. 6 shows an end elevation depicting more clearly the variable transmission gear at its maximum travel, whereas in dotted lines it is seen so situated that no motion is imparted to the clutch.

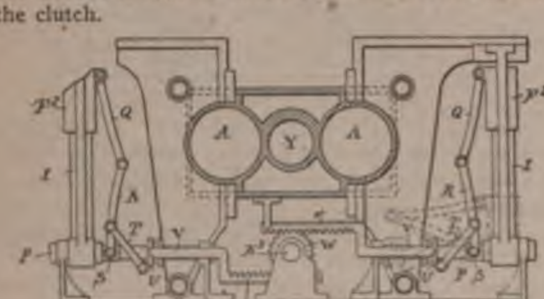


Fig 6

Claim.—In a variable transmission gear, the combination of a crank shaft, a rocking lever, a pitman connecting said crank shaft to said lever, an adjustable block slidably mounted on said lever, an expansible and contractible toggle for shifting said block, one member of said toggle being pivoted to the block and the other member to a sliding collared sleeve, said toggle rocking with said lever, a forked slide engaging said sleeve having a toothed rack on its end and a rotatable pinion engaging said rack, and means for rotating said pinion.

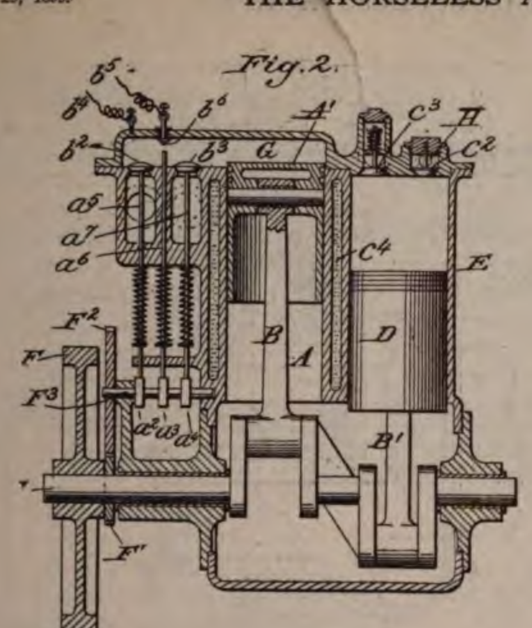
Claim.—In a motor vehicle, the combination of the open ended cylinder, the oppositely movable pistons therein, the opposite similarly rotating crank shafts driven by pitmen from said pistons, and the link connecting said crank shafts; with a vibrating lever, I, a pitman, H, connecting said lever to one of the said crank shafts, an adjustable block, F^2, on said lever, and a slide or crosshead, G^2, a pitman, J, connecting said slide to said adjustable block, a driven shaft, clutches, M, M^1, thereon and reciprocating rods, K, for operating said clutches, connected to said crosshead; with the toggle Q R for operating slide, F^2, the links T, collar U, rock bar V, gear W and shaft K^2, for operating said toggle.

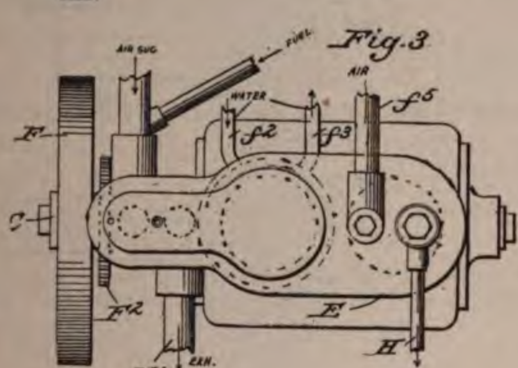
No. 637,660—Utilization of Compressed Air for Motive Purposes.—Edward E. Pettee and John J. McCutchan, New York, N. Y., assignors by mesne assignments to the Automatic Air Carriage Co., of New York. Filed March 9, 1899. Serial No. 708,422.

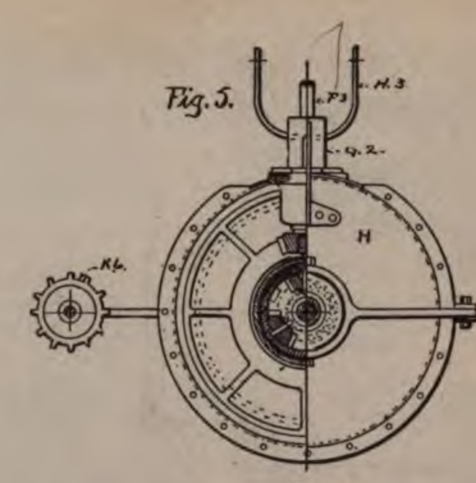
Fig. 2 represents in vertical section a suitable construction of air compressor appropriate for use in the system, and Fig. 3 represents a plan view.

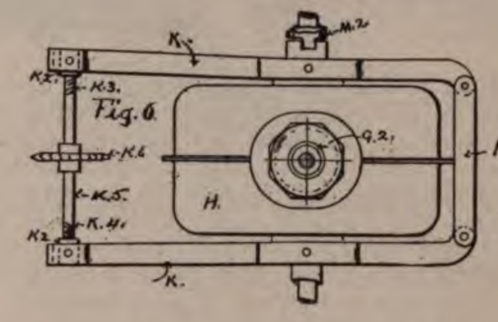
The distributing chests g of the motors f are supplied with compressed air from a conduit, H, leading from an air compressor cylinder, whose specific construction is illustrated (together with that of the explosive engine for operating it) in Figs. 2 and 3. Referring particularly to those figures, it will be noted that the piston A′ of the explosive engine is connected by a piston rod, B, with a crank shaft, C, having at its outer end a balance wheel, F, mounted thereon. The air compressor cylinder E is likewise provided with a piston, D, and is connected to the crank shaft C by a piston rod, B′, at an angle of 180 deg. from the point of attachment of the piston rod B. Upon the crank shaft C is mounted the gear F′, intermeshing with a gear, F^2, of twice the diameter of the gear F′. The gear F^2 is fixed upon a cam shaft, F^3, carrying a series of cams, a^2 a^3 a^4, upon which rest the lower ends of rods, a^5 a^6 a^7, provided with springs for maintaining them in contact with the working surfaces of the cams, as shown. To the rod a^5 is attached the valve b^3, which governs the inlet to the engine, and to the rod a^7 is attached the valve b^2, which governs the exhaust therefrom. The rod a^6 terminates at its upper end as a contact, adapted to close an electric circuit through the wires b^4 b^5 when brought into electrical connection with the insulated contact b^6, so that when separated from the contact b^6 an electric spark will result, thereby exploding the mixture of gas and air or of oil vapor and air in the space G. The explosion of this mixture causes the piston A′ to descend and the piston D to rise. As the piston D′ rises in the cylinder E the air within the cylinder is compressed and passes through the exit valve c^2 into the pipe H. On the descent of the piston D air enters through the spring-seated valve c^3 to supply the necessary volume of air for a subsequent compression.

When the explosive engine is at work and the throttle valve v′ closed, the air compressor may be employed for storing









compressed air at the predetermined pressure within the reservoir M′, thereby accumulating in said reservoir a reserve or surplus at a pressure limited by the safety valve M^2, said pressure being sufficient to start the motors under any load. For the purpose of starting the vehicle or for enabling it when under way to mount a steep hill or for a limited time to carry an abnormal load, we have at hand therefore an auxiliary high pressure supply amply sufficient for the purpose and which may be charged either when the vehicle is at rest or when it is moving under light load, in which latter instance the surplus pressure developed by the air compressor may be gradually accumulated in the storage receptacle for future use.

No. 637,750—Motor Vehicle.—John W. Ogden, Plainfield, N. J. Filed Nov. 4, 1898. Serial No. 695,523.

Claim.—In combination in a motor vehicle and with the driving wheel axles or axle thereof, two frictional clutches mounted concentrically with the axle, the driven members of which are connected to drive the wheels and are relatively

(*See Fig.* 5)

movable to and from the driving members along said axle, actuating connections from the motor to the driving members of the clutches turning them in opposite directions, and means for engaging either driving member at will to the co-operating driven member, by forcing them together in an axial direction.

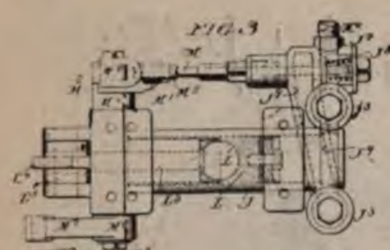
No. 637,297—Power-Transmitting Mechanism.—George S. Strong, New York, N. Y., assignor to John P. Murphy, Philadelphia, Pa. Filed Dec. 8, 1898. Serial No. 698,623. (No model.)

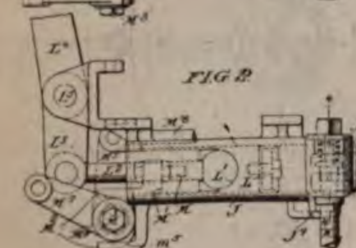
Claim.—In a gas engine, a shaft coupled to the piston or pistons of the engine in combination with a clutch, J^9, automatically acting to prevent backward revolution of the shaft, two clutches j^5, having actuating levers, j^4 j^5, extending out from them, said clutches being adapted when moved in the direction of rotation of the shaft to engage it and when moved in the other direction to disengage it, a pivoted lever, J^{13} J^{14}, and connecting rods, J^{10} J^{11}, coupling said lever with the arms j^4 j^5.

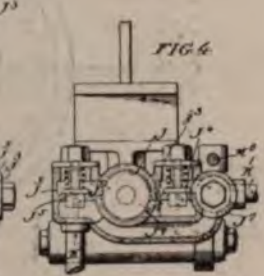
Fig. 2 is a side elevation, on an enlarged scale, of the pump which I use for controlling the position of the crank pin. Fig. 3 is a plan view of this pump and Fig. 4 a cross sectional view taken as on the section line 4 4 of Fig. 2. Fig. 7 is a face view of the crank-pin disk, Fig. 8 a cross sectional view taken on the line 8 8 of Fig. 7, and Fig. 9 a cross sectional view taken on the line 9 9 of Fig. 7.

A, Fig. 6, indicates one end of the crank shaft of the engine, which, as shown, is formed with a threaded extension, A′, of smaller diameter. The other end of the crank shaft is indicated at A^2, A^3 and A^4, indicating the cranks, and a continuous channel, A^5, being formed through the shaft and cranks, as clearly indicated, the said channel, however, in the portion A^5 of the shaft merging into a cylindrical enlargement, A^6, which in turn merges into a still further enlargement (indicated at A^7 A^8), the portion A^8 being internally threaded. As shown, the extreme outer end of the portion A^5 of the shaft is provided with an externally threaded projection, A^9.

B, Figs. 8 and 9, is a central projecting stud on the rear face of the crank disk, having a perforation at its end, adapted to receive the end A of the shaft and a threaded extension, B′, into which the threaded end A′ of the shaft screws, as shown in Fig. 6.







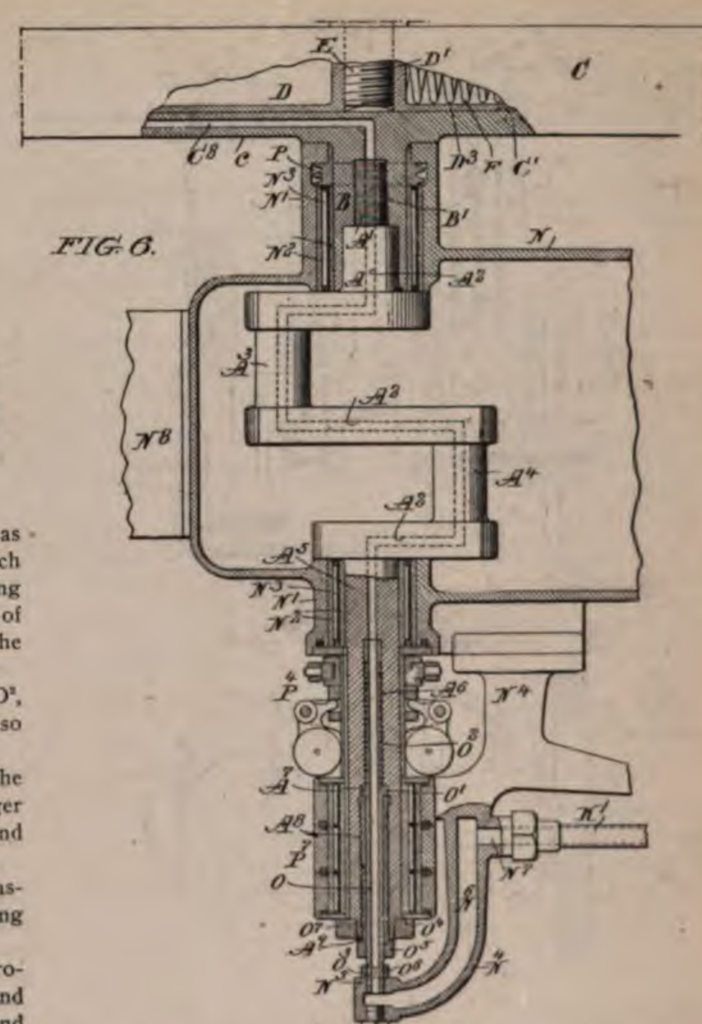


FIG. 6.

D is a plunger fitting and moving in the cylinder C′ and, as shown, formed with a threaded perforation, D′, into which screws the crank pin E, the position of this perforation being preferably such that when the cylinder D is at the bottom of its stroke the perforation will coincide with the center of the crank-pin disk.

The plunger D is formed with racks (indicated at D^2 D^2, Fig. 7), formed on its opposite sides, and, as shown, it is also formed with a spring-receiving cup, D^3, on its inner end.

F indicates a powerful spring situated in the portion of the cylindrical passage opposite to that in which the plunger works and arranged, as shown, to act against the plunger and hold it normally in the position indicated in Figs. 7 and 8.

G G, Figs. 7 and 9, are counterweights moving in the passages C^3 C^3 and formed with racks, G′, on their faces lying opposite to the plunger D.

H H are spur wheels situated in the passages C^4 and provided with journals which fit into the journal bearings C^5 and C^6, as shown in Fig. 9. These spur wheels are of a size and character to engage with their teeth in the opposite racks D^2 and G′, so that any movement of the plunger is necessarily concurrent with a movement of the counterweights in the opposite direction.

I is a face plate secured to and moving with the crank pin E in a groove formed on the face of the disk, the plate being of dimensions and character, as indicated in Figs. 7 and 8, to cover the slot C^2.

Any fluid introduced under sufficient pressure through the channels A^2 and C^8 will force the plunger D to move in the cylinder C′, overcoming the force exerted by the spring F and moving the crank pin E further away from the center of its disk, and the movement of the crank pin, as already noted, will automatically shift the postion of the counterweights which are arranged to balance the other moving parts contained in the disk and maintain the weight of the whole in a substantially balanced condition. A relaxation of the pressure by permitting the fluid to escape permits the powerful spring F to move the plunger back to or toward its normal position, shifting the position of the crank pin nearer to the center of the disk. The best method known for admitting and exhausting the fluid which controls the position of the crank pin is through the crank shaft of the engine, and where this method is availed of the fluid is carried from a pipe, K′, leading from the pump or other device where the necessary pressure and motion is given to the fluid, through channels N^7 and N^8, formed in a bracket, N^4, of the engine casing N. The channeled bracket N^4 has a perforation, N^5, at its end in line with the perforation A^2 in the portion A^6 of the crank shaft, and into this perforation N^5 a pipe, O, is screwed having threads, O^2, at its outer end and conveniently a jam nut, O^4, the said pipe extending through the threaded perforation A^8 and into the cylindrical perforation A^6, with which it makes a nice fit. The portion O^3 of the pipe, which fits in the cylinder A^6, is formed with a multiplicity of annular channels, which on well-known principles have the effect of preventing leakage. The pipe O is formed with a collar, O′, which will fit against the shoulder, A^7, formed between the portions A^6 and A^8, and the pipe O is secured in proper position in the crank shaft by a long heel nut, indicated at O^5, which screws into the threaded perforation A^8.

Referring now to Figs. 2, 3 and 4, it will be noticed that the pipe K′, to which reference has already been made, leads to the pump cylinder (indicated at J). This pump cylinder is formed with an admission port, J′, and an exhaust port, J^2, the admission port leading through a valve box, J^3, containing a non-return valve, J^4, into a supply pipe, K, leading to a reservoir, such as indicated, for instance, at K in Fig. 1.

(*To be continued.*)

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of THE HORSELESS AGE, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

WANTED.—*Vol. 1, No. 1, Vol. 2, Nos. 5, 6, 7, 8, 9, 10, and Vol. 3, No. 1.* A new number of the weekly will be given in exchange for any one of these, *if in good condition*, and for Vol. 1, No. 1, four numbers will be given if in good condition. HORSELESS AGE, American Tract Society Building, Nassau and Spruce Streets, New York.

HAND AND POWER PUMPS

FOR USERS AND MAKERS OF AUTOMOBILES.

GLEASON-PETERS AIR PUMP CO.,

20 WEST HOUSTON ST., NEW YORK, U. S. A.

½ to 2 H. P. Gasoline Motors

(WITH OR WITHOUT WATER JACKET)

FOR

AUTOMOBILES AND LAUNCHES.

VERTICAL OR HORIZONTAL.
ELECTRIC IGNITION. :: ::

☞ Large factory suitable for experimental work. Any style of carriage built to order from owner's drawings. Larger sizes for heavy vehicles in course of construction.

MALTBY AUTOMOBILE CO.,

10-12 Clinton Street, Brooklyn, N. Y.

FOR AUTOMOBILES

AND GASOLINE LAUNCHES

USE THE EDISON LALANDE BATTERIES.

LIGHT WEIGHT AND LIQUID TIGHT

CONSTANT CURRENT AND NO WASTE WHEN IDLE.

FULL DESCRIPTION IN BOOKLET NO. 5

EDISON MANUFACTURING COMPANY,

THOMAS A. EDISON, PROPRIETOR. 135 FIFTH AVENUE, NEW YORK.

The Woodruff Patent System of Keying...

Is used by The Largest Automobile Works in this Country For Keying Gears, Sprockets, Cranks, etc., to Shafts.

WE CARRY 41 SIZES OF KEYS AND CUTTERS IN STOCK AND MAKE SPECIAL SIZES TO ORDER.

SEND FOR CIRCULAR.

THE

WHITNEY MFG. CO.

HARTFORD CONN., U. S. A.

Size, 7 high X 4½ for Stationary Engines.
Size, 7 high X 4 for Automobiles.

O K DRY BATTERY.

NEW GAS ENGINE TYPE.

THE PROBLEM SOLVED.

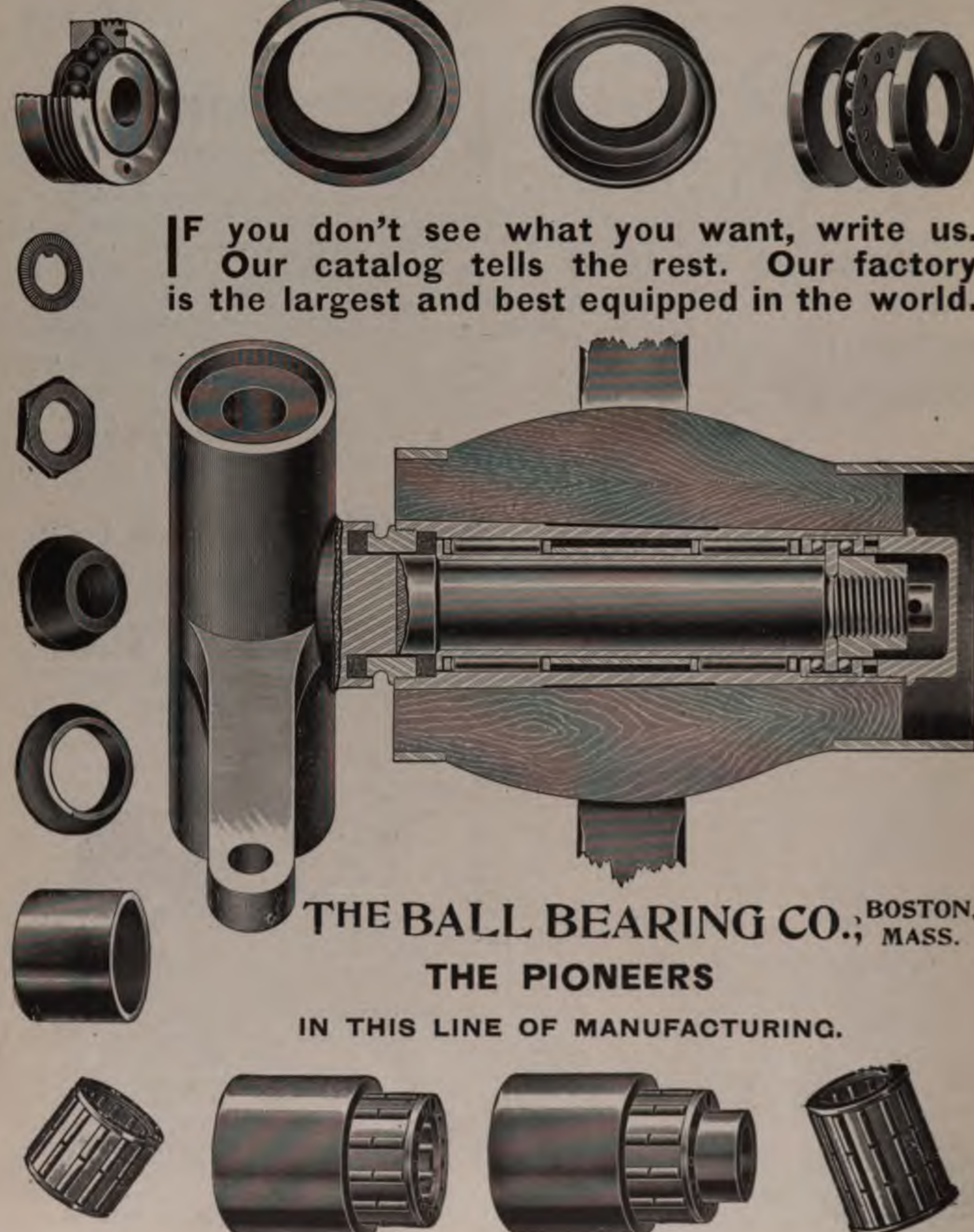
No solution to slop over. No missing of sparks. Highest voltage. Quickest recuperation. Long life. Unaffected by heat or cold. Compactness.

Non-Polarizing Dry Battery Co.,

625 BROADWAY, NEW YORK.

POINTS IN ORDERING.

1. Name of engine.
2. Number of revolutions per minute.
3. Number of sparks per minute.
4. Mode of ignition, whether by spark coil or induction coil.
5. If spark coil, whether butting or wiping spark.
6. Kind of spark contact points, whether platinum, steel or other material.
7. Average number of hours per day engine is run.


IF you don't see what you want, write us. Our catalog tells the rest. Our factory is the largest and best equipped in the world.
THE BALL BEARING CO.; BOSTON, MASS.
THE PIONEERS
IN THIS LINE OF MANUFACTURING.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS

VOL. V. NEW YORK, DECEMBER 6, 1899. No. 10.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

Steam Boiler Number.

In the present issue we have endeavored to give the readers of The Horseless Age a good deal of information about steam and its advantages and disadvantages for motor vehicle work and to show the lines of thought on which the best American steam engineering talent is working to-day.

We have called this issue our Steam Boiler Number because the boiler is the most important part of a steam vehicle outfit, and we were desirous of directing special attention to it and stimulating improvement in this particular branch of motor vehicle engineering.

We believe our efforts have been fairly successful. Within these pages are assembled the best thought and the timely suggestion of many fruitful minds. All phases of the question are either touched upon or clearly elucidated. The present consensus of opinion is therefore not difficult to find. Great stress is laid by all our contributors upon safety, the first essential of a vehicle boiler, yet one of the points which has been ignored by early manufacturers who rushed prematurely into the industry without investigating its requirements. In a steam boiler, whatever its use is to be, weight is a consideration wholly secondary to safety.

Other essential points which have received careful attention in this number are: Boiler feeding, fuel, general type, cleaning, corrosion and stoppage, circulation, license, condensation, resistances, etc. The difficulties encountered in designing for this special service are frankly stated and the various practical methods of meeting them are discussed with equal freedom. The whole spirit and tone of the papers is one of thoughtful investigation and fair minded discussion, which we sincerely hope to make the keynote of all future issues of The Horseless Age.

We thank our contributors for the splendid symposium of technical knowledge and special research which they have enabled us to lay before our readers. No one can read this Steam Boiler Number without realizing that steam has a great future in the motor vehicle industry. The foundation for an industry is already laid. The promoters are falling into the background; the engineers at last are coming to the front. The Horseless Age will endeavor to keep them there.

Steam Vehicle Licenses.

Pioneer makers of steam carriages in America have overlooked the question of license, as they have many others of equal importance. Carried away by the tide of enthusiasm, they imagined the motor industry to be as smooth and lovely as a summer sea. They are beginnig to discover that there are many dangers and difficulties in the way, demanding a more cold and critical frame of mind than that which inspired them with rosy visions at the start. Hard facts are staring

them in the face. One of these facts is the license question. Will licenses be demanded of all operators of steam vehicles, as they are of operators of marine and stationary boilers? Or are there good grounds for making an exception in favor of certain classes of vehicle boilers?

These questions were long ago propounded by The Horseless Age, and a general discussion of them was recommended. The newly organized Automobile Club of America was mentioned as a proper body to take up the matter and petition the authorities, if such a course seemed advisable.

Manufacturers have been turning out steam vehicles in quantities for the general market; many of these carriages have fallen into the hands of unskilled operators, and much trouble and in some cases dissatisfaction has resulted, due very often to the ignorence of the operators.

The inspectors of steam boilers have been aroused by this sudden appearance of the steam carriage upon our streets and the evident incompetence of some of the operators, and are requiring licenses of one form or another. The interference of the inspectors is already so general that it may be accepted as certain that some form of license will be demanded of every operator of a steam vehicle. This being settled, the all important question for the maker and user of steam vehicles is, What system of licenses shall be adopted? Is it necessary for the user of a steam pleasure carriage to hold the same kind of a license as the driver of a steam omnibus or truck?

We have intimated that a system of graded licenses might be acceptable to the authorities, and similar views, we believe, are entertained by many owners of steam carriages as well as by some officials who have had occasion to pass judgment on this matter.

To demand a full engineer's license of the operator of a light steam carriage would be to seriously cripple the industry. Boilers of suitable type and of sufficient factor of safety can be built for this work so as practically to preclude the danger of explosion. Some of the boilers turned out on light carriages have not been of this character, and could not possibly meet the approval of conscientious inspectors. This is a grave mistake. At this early period especially the ncessity is paramount of generous weights and honest engineering construction in all vehicle boilers for whatever type of vehicle they may be designed. The applicant for a license may be adjudged competent, while his machine may be condemned. Let the manufacturer see to it, then, that he fulfills the just requirements of the law with respect to safety.

Lead Cab Trust Denials.

In a letter to The Horseless Age Herbert M. Lloyd, one of the presidents of the Lead Cab Trust, denies the Trust's intention to put on gasoline cabs in connection with the Lead Cabs now operating in New York. Notwithstanding this negative statement the report is quite generally current, and the acquisition by the same group of capitalists of the Panhard-Levassor patents on gasoline cabs and other gasoline vehicles for the United States lends strong support to it. As it is about the only way out of the awkward dilemma in which the Lead Cab Trust finds itself, the denial comes dangerously near to stultification. But those who agree with Thomas A. Edison in his estimate of storage battery inventors and promoters will probably conclude that Lead Cab denials carry much less weight than Lead Cabs.

"The Insolence of Office."

Jules Junker, of Philadelphia, whose wife was recently arrested in Fairmount Park for violating the rule restricting automobiles to certain drives, favors us with a communication criticising the action of the authorities in making the arrest and scoring the "insolence of office" which he regards as the real underlying cause of this and similar abuses of police power in the United States. He also calls attention to the loose and irrelevant statutes which are continually being introduced to hamper the individual and add to the power of the swollen and arrogant executives of the law.

All this is too true. Every intelligent observer of our system of making and enforcing the laws will admit it; but before the herculean task of cleansing the Augean stables of American politics the editor of The Horseless Age recoils. The horseless movement is quite arduous enough.

Steam Vehicles.

In this number of The Horseless Age we present an extended consideration of the merits and demerits of steam as a motive power for road locomotion. Not only the history of the steam boiler and its attachments has been considered relatively to the progress of motor vehicles of the past, but several highly interesting suggestions have been advanced for the steam propelled carriage of the future. The well-known character of the steam engine and the apparatus connected thereto gives weight to the hopes expressed by many that this source of energy will be the most generally effective and trustworthy. The conditions, however, under which the steam engine and boiler are to be applied to a carriage for use in city streets require very careful investigation, and the efforts of inventors should in all cases be directed along those lines that experience has demonstrated at once durable and safe. Many inventors could save themselves expense, both of money and time, by taking some reliable boiler insurance company into their confidence before inflicting possible injury either to themselves or the general public.

The hydrostatic test does not tell the whole story by any means, the expansion from heat bringing an altogether different set of strains upon the structure to those produced by the cold water pressure. Due provision must be made for unequal expansion of the several parts.

There should be sufficient area of water and steam space to secure steadiness of the water level even at full rated capacity and avoid any possibility of the steam carrying over the water in the form of spray into the engine cylinder. On the other hand, if the steam and water area is too large, the boiler is sluggish and wasteful of fuel, while the heat retaining difficulties are increased.

Joints should not only be few in number, but removed from the direct action of the flame, and it has been proposed to avoid threaded joints entirely and weld the parts by electricity. One of the old objections to the simple coil boiler was the difficulty of making repairs. This trouble may be overcome by latter day methods, such as the electric welding process.

It is not likely that the several statements made by the writers of the articles in this issue will in all cases receive unanimous support, and we shall look forward with pleasure to the receipt of criticisms from our readers. Here and there we have noted a point that seems at variance with our own impressions, as, for example, in the excellent paper on the Thomson flash boiler we are told that, among other reasons, the Herreshoffs abandoned one type of boiler because of a system of return piping which did not permit of forcing the water through overheated tubes. This objection is probably valid against the earlier boilers of that particular type, but in the later ones the separator was connected to a circulating pump, and with the aid of a gauge glass on the separator a sufficient height of water was maintained to guarantee a circulation through the tubes.

Serpollet, so far as we are aware, has not succeeded in obtaining as light a steam generator as the one described in the paper by L. H., and we shall follow the experiment of Prof. Thomson with interest.

Questions of safety, efficiency, general and specific design of steam generators, as well as detailed descriptions of the better known steam carriages, boilers, feeders and burners, are here submitted at length and need no further introduction to the student of this branch of engineering.

An English engineer, Mr. Geo. A. Burls, has lately submitted some suggestions in reference to the power required for an automobile, and as his views were submitted in connection with steam propelled carriages rather than any other system of propulsion, we here submit his statement:

"Surprise has often been expressed at the apparently great power needed for the propulsion of automobiles; one is told that, say, a 3-ton vehicle is fitted with engines of from 25 to 30 i.h.p., and at first sight it seems difficult to believe that so much can really be necessary. A little consideration, however, easily removes the difficulty. Remember, firstly, that the horse is, compared with the steam engine, an intelligent agent, and that in virtue of this intelligence he is enabled to exert on special occasions a tractive effort enormously in excess of his average. At last summer's Engineering Conference it was stated by Mr. Steavenson that one horse has, during several seconds, developed as much as 13 engineers' h.p., this extreme rate being occasionally required on starting a heavy load, drawing out of a soft place or ascending a short, stiff rise.

"The steam engine, on the contrary, immediately stops dead on experiencing a resistance to the motion of its piston equal to the effective steam pressure multiplied by its area. One is consequently compelled to fit the steamobile with an engine capable of working with certainty and ease at the maximum rate ever likely to be attained. Taking the efficiency of the transmission, from piston to road wheels, at two-thirds, one sees therefore that a steam engine capable of indicating $13 \div \frac{2}{3} = 19\frac{1}{2}$ h.p., as a maximum, must be fitted to an automobile capable of replacing one of the unusually powerful animals referred to. It is, however, obvious that such an engine will, on the whole, do far more useful work than the horse it nominally replaces, its average working rate being considerably greater than could be maintained by the animal. But with the speeds and pressures now safe, and in common use, an engine of 25 or 30 i.h.p. is a very small affair, and can easily be constructed as a horizontal, inclosed, compound, weighing under 5 cwt., and stowable in a box $3\frac{1}{4} \times 2\frac{1}{2} \times 1\frac{1}{2}$ ft., having ample bearing surfaces to insure durability in continuous running, and a good constant lead, variable cut-off and reversing gear, enabling the power to be varied from 5 to 25 i.h.p. or more, with very fair economy throughout. Such an engine possesses thus a considerable range of output of energy, which may be still further widened by varying the boiler pressure. The starting effort on the road wheels may again be still further increased by the adoption of a slow-speed gear between the engine and final drive.

"Thus it will be seen that though the engine is designated by its maximum horse-power, it is rarely only that such maximum is developed, and by the simple and entirely practicable expedients indicated the power of the steamobile is rendered capable of sufficient variation to meet all the contingencies of ordinary transport. It is largely due to this flexibility that the steam engine has, so far, distanced all rival systems proposed for use with heavy load automobiles. How satisfactorily the varying demands of everyday service are fulfilled will be better appreciated when the hill-climbing performances at the recent Liverpool trials are referred to."

Let not the designer in his desire to produce an extremely light generator overlook the surplus power, if it may be so termed, that should be provided for everyday road service. Good level roads are not universal, and if the machine does not have ample supply of energy in reserve to maintain speed under adverse circumstances of roads and grades the results will be humiliating. Whether under such conditions it is best to employ an engine and boiler which would mean an increase in size and consequent weight above that normally required or whether a smaller outfit should be supplemented by gearing and clutches to temporarily increase the turning torque at the expense of speed, are matters calling for individual thought and study.

The general flexibility of the steam plant, the mass of information to be had concerning design and equipment, render steam particularly attractive to investigators in road propulsion and motive powers, and while it may not present the future possibilities that seem probable to the oil engine for popular passenger and pleasure conveyance, it will nevertheless have its peculiar place and field of activity and we are pleased in this number of The Horseless Age to have given special attention to the steam boiler. R. I. CLEGG.

Steam Boilers for Motor Vehicles.

By R. I. Clegg.

It is not at all an easy matter to realize that a century ago very many of the problems now seeking solution were under grave consideration by enthusiasts in the automobile art. One, however, has but to understand that fact to know how difficult the task will prove to design some useful form of steam generator suitable for automobile service that will successfully withstand the scrutiny of the Patent Office. The writer does not propose to go at great length into the past history of steam boilers or even of that class most likely to be of service in the propulsion of vehicles, but will endeavor as briefly as an intelligible summary will permit to present those features of boiler practice, in the past and present, as may seem most applicable and valuable in the study of our specialty—i. e., highway locomotion.

The subject is of great antiquity, as viewed by some investigators. Farman states that there are documents dating as far back as the Egyptians showing a car propelled by the action of steam escaping into the air.

CUGNOT'S STEAM BOILER.

Probably the first steam propelled automobile is the one devised by Nicholas Joseph Cugnot, a French officer of artillery, in the year 1763. In 1769, Cugnot built a long trolley or gun carriage operated by steam. This is a three-wheeled machine, the single wheel being power driven and capable also of rotation about a vertical axis, or king pin, for steering purposes. This method, combined with the placing of the boiler on the same swinging frame, is, by the way, the suggestion of the self contained power driven fore carriage which has been exploited to some extent abroad by the firm of Riancy de Givin and others. Cugnot's carriage is still in existence, carefully preserved at the Conservatoire National des Arts et Métiers in Paris. The boiler was a simple kettle shaped affair, similar to the one devised by Smeaton, with a fire box formed in its base, and a steam pipe led from the dome to a two-way valve communicating with a pair of vertical bronze cylinders.

EARLY BOILER PRACTICE.

Dr. Thurston has summarized the earlier progress of steam boiler practice so ably that I quote his description of the results following the ever present desire to obtain the maximum efficiency as well as safety, the former producing the tubular boiler and the latter the so-called "sectional boilers."

As early as 1793 Barlow invented and with Fulton used the water tube boiler, in which the water circulates through the tubes instead of around them, as in fire tube boilers. This was the pioneer of a great variety of boilers of this class.

John Stevens, a distinguished statesman as well as a prominent engineer, devised an example of this class in the year 1804. The inventor says in his specifications: "The principle of this invention consists of forming a boiler by means of a system or combination of small vessels, instead of using, as is the common mode, one large one, the relative strength of the materials of which these vessels are composed increasing in proportion to the diminution of capacity." The steamboat boiler of 1804 was built to carry a working pressure of over 50 lbs. to the square inch at a time when the usual pressures were from 4 to 7 lbs. It consists of two sets of tubes, closed at one end by solid plugs and at their opposite extremities screwed into a stayed water and steam reservoir, which was strengthened by hoops. The whole of the lower portion was inclosed in a jacket of iron lined with non-conducting material. The fire was built at one end in a furnace inclosed in this jacket. The furnace gases passed among the tubes, down under the body of the boiler, up among the opposite set of tubes and thence to the smoke pipe. In another form, as applied to a locomotive in 1825, the tubes were set vertically in a circle (double) surrounding the fire. These boilers are preserved in the collection of the Stevens Institute of Technology.

Another modification of this type is found in the boiler used by Sir Gouldsworthy Gurney in his steam carriages, constructed during the years from 1822 to 1835. Gurney's generator consisted of bent steam pipes of small diameter so connected with steam and mud drums as to make a very efficient as well as safe and powerful boiler for use where lightness and safety were essential characteristics. Similarly, the special demands of locomotive construction were not fully met by the single-flue boiler first used by George Stephenson and his colleagues in 1815, and up to the time of the construction of the Stockton & Darlington Railway in 1825, an example of which is still preserved in the first locomotive built for that road. At the opening of the Liverpool & Manchester Railway, in 1829, Stephenson's Rocket was given a multi-tubular boiler, a form which had grown into shape in the hands of several inventors. This boiler was 3 ft. in diameter and 6 ft. long, and had 25 3-in. tubes, extending from end to end of the boiler. The steam blast was carefully adjusted by experiment to give the best results, and steam pressure was carried at 50 lbs. per square inch.

The average speed of the Rocket on its trial was 15 miles per hour, and its maximum was nearly double that, viz., 29 miles to the hour; and afterwards, running alone, it reached the speed of 35 miles.

The requirements of a quick-steaming boiler are very severe in steam fire engine practice, and some very ingenious designs are exhibited in this line of work. The Silsby Co.'s boiler is 55½ in. high from base to dome, and 36 in. above that to the top of stack. Internally the boiler is 36 in. in diameter and the fire tubes are 2 in. in diameter and 21 in. long. A large number of Field tubes are screwed into the crown sheet—the end of boiler nearest to furnace—and hang at a slight angle with a view of facilitating the circulation. These are water tubes, the furnace gases playing around them and then passing upward and through the fire tubes connecting the crown sheet with the top of boiler. This construction makes a very light, compact and powerful steam boiler. A Field tube is, I may add, closed at one end and containing an inner tube or partition. The most intense heat is intended to act directly upon the closed end, and the rapid circulation of the water around and through the partition is supposed to prevent incrustation. Whenever possible the tubes are pendent at a slight angle. Thirty degrees from the vertical is claimed as the best theoretical position, though, of course, there are other questions concerning the construction of the other parts of the boiler that may prevent this requirement being strictly obtained in all cases.

In Fig. 1 is shown a sketch of Cugnot's steam generator. The steam and water space is indicated by 1, while 2 represents the combustion chamber; 3 is the smokestack and 4 and 5 are steam pipe and supporting flange, respectively. It is worth

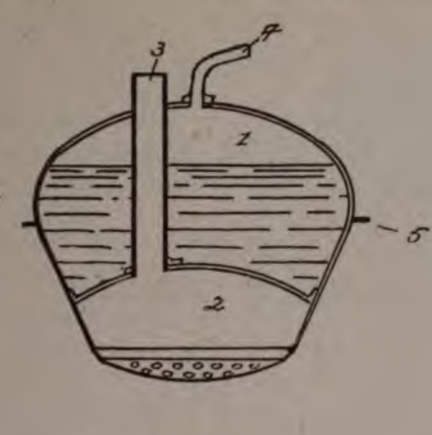


Fig. 1

noting that the designer in his arrangement of the stack, or flue, passing through boiler as well as the dome shaped combustion chamber, recognized the advantage of increased heating surface wherever practicable. The boiler is about 5 ft. in diameter, with a 6-in. smokestack.

MURDOCK'S STEAM BOILER.

William Murdock was another early pioneer whose work shows a keen appreciation of the requirements of steam engineering applied to motor vehicles. In Fig. 2 I have a sketch of the boiler on Murdock's steam carriage. The combustion chamber, 2, tapers until merged into the smokestack, 3. The

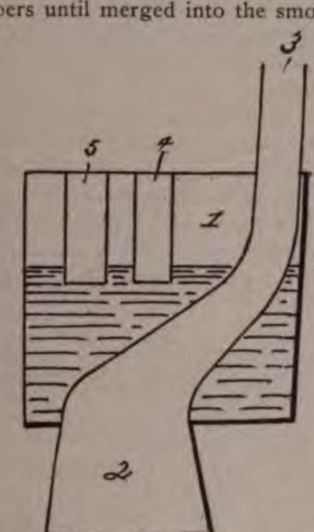


Fig 2

steam space, 1, also contains the engine cylinders, 4, 5, which are thus jacketed with live steam, a condition of affairs approved by many in these modern days. The length of the curved flue, in the water space, shows that here too increased heating surface was carefully sought by these early engineers. This, as has been shown, was the choice of the railroad engineer, Stephenson, but by an easy and natural transition he increased the heating surface by adding tubes, as in the tubular boiler already described. Murdock's carriage was a tricycle. At the forward end a post was erected; to the top of the post was pivoted a beam extending the length of the machine, and at the opposite end to the post connected to the pistons and connecting rod. The boiler was placed over the rear axle. The rear axle was bent to form a crank and both wheels appear to have been driven. The long overhead beam gave a fair approximation to a parallel motion, and it is very likely, as the record would indicate, that the carriage was a successful and highly creditable piece of work. Murdock's model is said to be still preserved in the Birmingham (England) Museum.

STEAM CARRIAGE—INFANCY AND PROGRESS.

In 1786 Wm. Symington built a steam road coach in England and in the same year Oliver Evans applied to the Legislatures of Pennsylvania and Maryland for a patent on steam wagons and began the construction of one. Although this vehicle does not appear to have been finished, we are told that about this time he undertook successfully the transportation of an engine and boiler from his factory to its destination by placing them on wheels and gearing the wheels to the crank shaft.

Nathan Read in 1790 applied for a patent on a steam carriage and constructed a model. He proposed to use two double-acting steam engines, and the design is particularly noteworthy because of the inventor's use of a multitubular boiler.

During the closing years of the last century Richard Trevithick constructed several models, and in 1801 a full sized steam coach capable of carrying seven or eight passengers. Space will not permit of a recital of the labors of Brunton, James, Anderson, Danse, Hancock and others in this work.

SQUIRE'S STEAM BOILER.

One of Gurney's employees, J. Squire, afterwards went into business on his own account, and, assisted by Col. Macerone, built several vehicles.

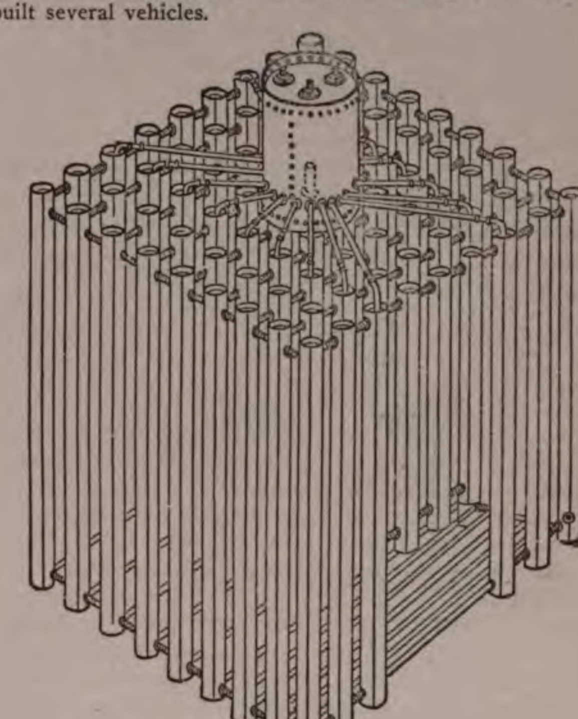


Fig. 9

The Macerone & Squire boiler is shown in Fig. 9. It is a vertical water tube boiler with a central steam dome, to which the upright members are connected by the converging

tubes. The engine was mounted between the frames and the pistons operated on cranks on the rear axle; cylinders were 7½ in. diameter by 15¾ in. stroke; furnace was fed from a hopper and forced draft was secured by a fan, belted from a pulley on one of the rear wheels. We are told that the coach ran 1,700 miles without repairs; that coke was used for fuel at a cost of about 7 cents a mile; that the average speed was 14 miles an hour, and the boiler pressure was 150 lbs. to the square inch. This latter statement seems doubtful, though we must concede this much: That the old-time designer was equally daring as well as brilliant in his sphere. Pressures of such magnitude were not, however, in general use for long after Squire's period of activity.

There are several notable features—the forced draft, the hopper-fed furnace, etc. Had the steam receiver been lengthened to the base of boiler and the lower end of each tube connected thereto, we should have the Fowler boiler, which has been put out during the last decade.

SCOTT RUSSELL'S BOILER.

So far as I can ascertain, the Squire boiler was wholly of iron; but the constructor of the Great Eastern steamship, Scott Russell, employed copper for his steam generators. His boilers were rectangular, similar to Murdock's, the copper sheet 1-10 in. thick and stayed with some 1,300 copper stays. The engine cylinders were 12 in. in diameter by 12 in. stroke.

Mr. Sennett tells us that the Scott Russell carriages were most elaborately fitted up, designed with great care and ran very successfully. In 1846 a service of six of these steam carriages plied regularly between St. George's Square, Glasgow, and Paisley (Scotland). The trips were made every hour and were well patronized. They were constructed for 6 inside and 20 outside passengers, but frequently carried 40, so that Scott Russell, who had wisely supplied his carriages with ample boiler power, caused them to drag after them a kind of dog cart, carrying at the same time six passengers and a supply of fuel and water, the water tank being connected with the feed pump upon the coach by an india-rubber pipe.

MODERN STEAM CARRIAGE BOILERS.

Let us compare these early attempts with modern efforts in steam road locomotion. Fig. 3 is a vertical section of the

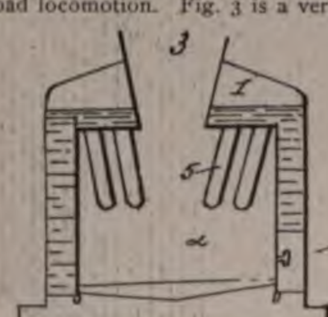


Fig 3

steam generator devised by M. Amédée Bollée for his omnibus, La Nouvelle, built in 1880. La Nouvelle took part in the Paris-Bordeaux race and came in ninth, owing to an unfortunate accident at the start. Although ninth, M. Bollée's car was the first to come in of the steam cars taking part in the race.

In Fig. 3 the water and steam space is represented by 1, 2 is the combustion chamber, 3 the smokestack, 4 the fire door and 5 the Field tubes.

The Field tube has already been mentioned in connection with the Silsby steam fire engine boiler, and in Fig. 4 a sketch is given of its arrangement and action:

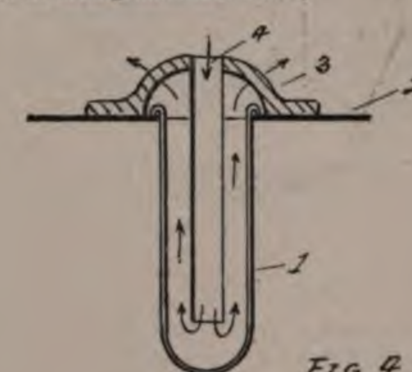


Fig 4

The outer tube 1 in Fig. 4 is riveted to the tube sheet 2 and contains a small tube, 4, held in the center of 1 by the collar 3. The flange or collar 3 is riveted to 2, suitable openings being made in 3 for circulation, as shown by the arrows. The lower part of these tubes being most exposed to the heat, the water will circulate rapidly in the direction shown by the arrows, so that the simultaneous heating of the whole of the contents of the boiler will be greatly accelerated, the heating surface will be utilized to its greatest extent, consequently giving the boiler a high steaming efficiency. Mr. Farman states that the water circulates so rapidly in the tubes that there is no incrustation in the boiler and that the generation of steam is so rapid that these boilers have been favored for fire engine purposes. The rapid circulation in the Field tube, when properly designed and placed, keeping the surfaces clean and in a high state of efficiency, seems to be accepted as a fact by Dr. Thurston in his report on the Allen experimental steam boiler.

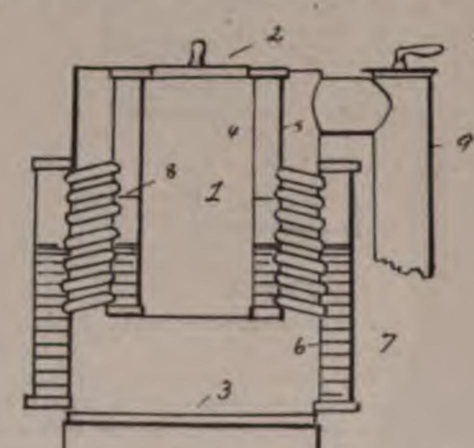


Fig 5

The outside diameter of the boiler used in the Bollée omnibus is 30.31 in., and it contains 118 tubes. Steam is got up in 20 minutes, boiler pressure registered at 142 lbs., supplying superheated steam at 300 deg. centigrade. An evaporation is

claimed of 20.5 lbs. of water per square foot of heating surface per hour. Engine has two cylinders at 45 deg. to each other; diameter 5.9 in. and the stroke 6.29 in. The outfit is rated at 15 h.p., but is said to be capable of very much more than this at full pressure.

In Fig. 5 we have the De Dion & Bouton steam boiler. The sketch shows a vertical section through the boiler. Fuel is passed down through the central tube 1, which at other times is closed by the cap or cover 2, on to the grate at 3. There are two annular steam and water spaces inclosed by the plates 4 and 5, 6 and 7. These are connected by a series of tubes so arranged as to impede the gases and absorb their heat. A diaphragm, 8, between 4 and 5, forces the steam to pass through the upper bundle of tubes, thus drying it thoroughly.

The steam is superheated before passing into the cylinders by passing the steam pipe through the fire box casing so as to avoid as far as possible condensation o nthe motor wells. Mr. Roper, an American steam motor enthusiast, placed his cylinders in the smokestack in one instance, and in another case passed part of the products of combustion around the cylinder.

In Fig. 5 the gases of combustion pass off to the rear of the car by means of the stack 9. Owing to the arrangement adopted a fairly strong current of water passes in the tubes, which facilitates steaming and prevents the tubes getting foul too rapidly. This circulation of water is caused by the difference in temperature in the lower and upper tubes, and it will easily be seen that in the space 4 5 the current has an upward and in 6 7 a downward direction. The following figures will show the advantages of these boilers at once:

Heating surface	22.76 sq. ft.
Grate area	1.86 sq. ft.
Weight, empty	528 lbs.

This boiler is sufficient for an 18 h.p. engine, which is remarkable for a boiler weighing 528 lbs. The boiler evaporates about 6 lbs. of water per pound of coke. Its efficiency is therefore high, and, from this point of view, slightly superior to that of the Serpollet generators. I am indebted to the Locomotion Automobile (France) for the foregoing notes on the De Dion & Bouton generator.

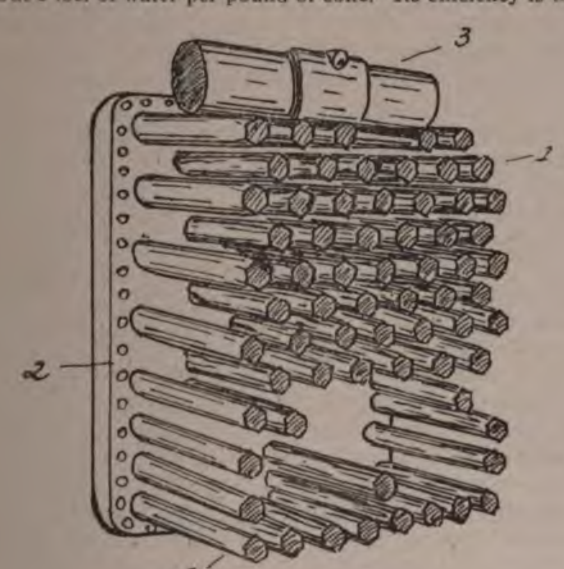


FIG. 6

In Fig. 6 is shown the boiler in use on the Cross steam carriage; the sheet iron casing, asbestos lagging, as well as the stack, being removed. The general features of this vehicle have already been illustrated and described at some length in The Horseless Age, and it is needless at this time to do more than submit a brief sketch of the boiler. The weight of the boiler is about 450 lbs., empty, and it holds about 10 gals. of water. The horizontal tubes, 1½ in. diameter, are plugged and swaged to a hexagon shape at one end and threaded, 24 to the inch, at the other. The hexagon end is for the application of a suitable socket wrench. The boiler back, 2, is formed of two steel plates with a 3-in. by 1-in. separating ring of wrought iron riveted between the plates. The steam drum 3 is composed of a central casting with two large plugged tubes screwed therein. The boiler is very heavy, but on the other hand is readily repaired and will stand a 600-lb. test.

The Roper, Whitney and Stanley boilers, which have been described hitherto in these columns, are upright tubular generators. The first two use a steel shell and copper tubes, while the Stanley Bros. have both shell and tubes of copper, the shell being reinforced by three layers of piano wire. Like a good many other ideas, it seems to have been adopted by others for the strengthening of vessels and tanks. Along in 1874 a reissue was granted (Feb. 17) of an earlier patent (Jan. 30, 1872), granted to Phillip Lesson, of Newark, N. J. The invention consisted in an arrangement of a jacket made of closely wound metal wire coated with and united with the body of the vessel by tin, the jacket being applied to the body of the vessel in such a manner that it is strengthened uniformly, thus enabling the manufacturer to reduce the weight of the sheet metal in the body; also to dispense with strengthening hoops, etc. The invention also covers a device for retaining the ends of cut wires in place where a hole has been cut in side of reservoir.

Another United States patent on same subject is the one granted to John H. Stone, of Toronto, Canada, Dec. 13, 1898. Stone strengthens a thin copper shell by winding wire, "preferably gun wire or similar wire of great tensile strength," and also, as in the previous patent, goes into details as to sweating and fastening the wire.

BOILERLESS STEAM ENGINES.

In an esteemed contemporary we have noted several mysterious hints as to experiments now under way with the avowed purpose of discarding the boiler, or, as the phrase goes, "using a steam engine without a boiler." Whatever the scheme may be that is now, we trust, progressing toward success, there is no doubt that long ago the idea of getting rid of the boiler has received due consideration.

In a communication to the American Mechanical Magazine, June, 1825, an account of a "steam engine without a boiler" is published as contained in the specifications of letters patent granted to Joseph Hawkins. The patent was subsequently assigned to Dr. Planteau, of Philadelphia. The scheme was really a flash boiler, as it is now termed, a heavy wrought or cast iron cylinder being placed in the furnace. When used for a 6 h.p. outfit with a horizontal cylinder, the latter was recommended to be about 10 ft. long and 7 in. in diameter, with a thickness of about 4 in. When the furnace is supplied with fuel, so that the cylinder becomes hot, a valve is turned admitting water from a reservoir, placed at a suitable height,

when the water passes into the cylinder, where it becomes instantly rarefied into steam and passes off with great force.

Some experiments have been quietly carried on in Rhode Island with a view to splitting up water into its component elements and driving a small motor for vehicle propulsion by one of these. An account of these experiments is not to be had, and probably the experimenters ran against one or more of the difficulties that beset the hydrogen motor. At any rate the matter seems to have been quietly dropped.

THE SERPOLLET BOILER.

The patent of Hawkins is one of the earliest accounts I have found detailing at some length the same idea which was carried out so brilliantly by the French Serpollet.

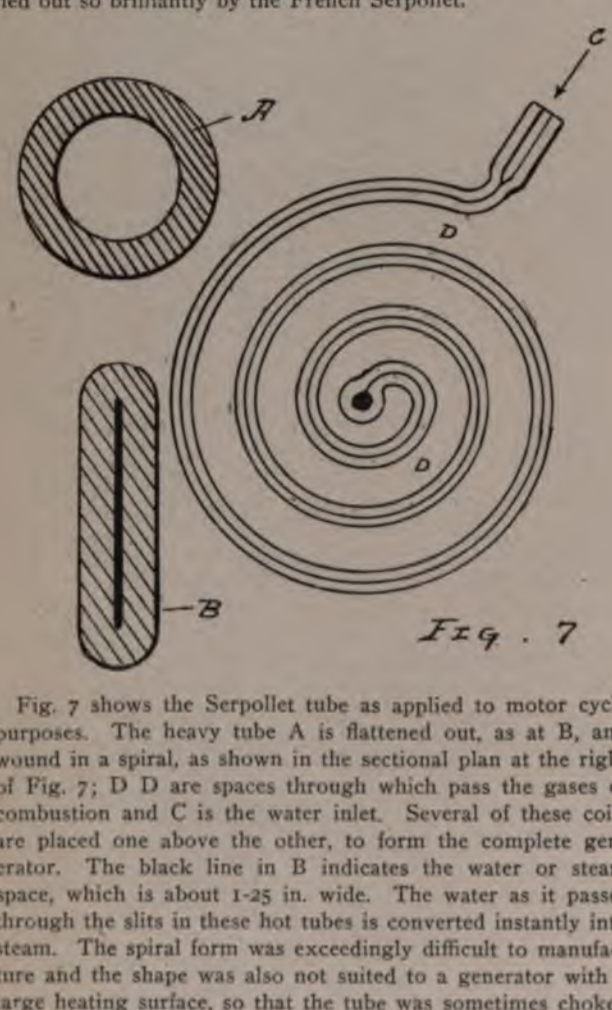


Fig. 7

Fig. 7 shows the Serpollet tube as applied to motor cycle purposes. The heavy tube A is flattened out, as at B, and wound in a spiral, as shown in the sectional plan at the right of Fig. 7; D D are spaces through which pass the gases of combustion and C is the water inlet. Several of these coils are placed one above the other, to form the complete generator. The black line in B indicates the water or steam space, which is about 1-25 in. wide. The water as it passes through the slits in these hot tubes is converted instantly into steam. The spiral form was exceedingly difficult to manufacture and the shape was also not suited to a generator with a large heating surface, so that the tube was sometimes choked up and the power somewhat limited. Subsequently the tubes were made straight and short, arranged in parallel and in pairs over the fire. These were not successful, the sides bulging out when the tube was overheated. To get over this difficulty M. Serpollet altered the shape of the tubes and hit upon the idea of making them with a U or gutter section, as at A in Fig. 8. These tubes are made in pairs, vide B, same figure, each pair being termed a Serpollet element. This element is formed by a steel tube, originally cylindrical in section, solid drawn in its middle portion and at its two extremities, and stamped by a special die in the form of a U in its two intermediate parts. The two ends are threaded and the middle part bent as shown at B. The elements are then placed

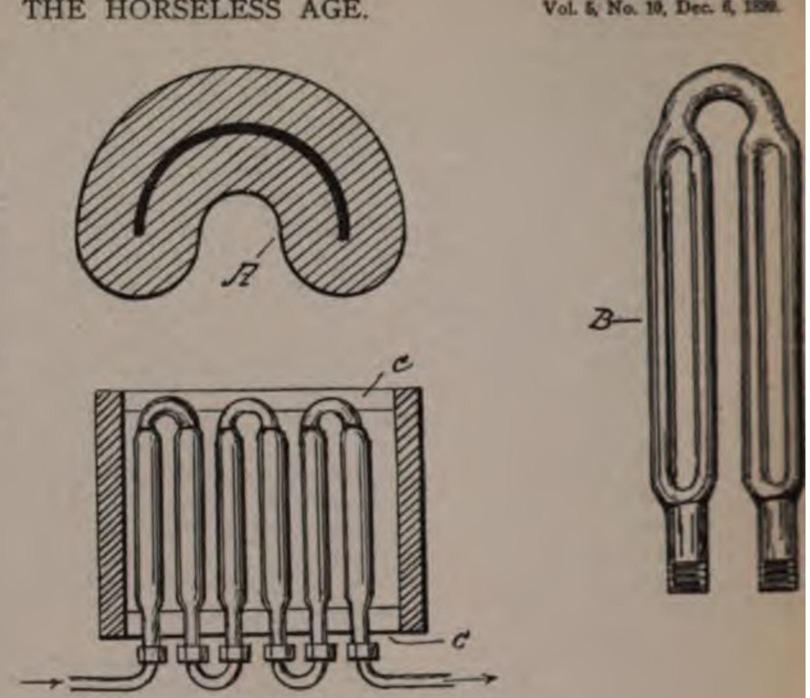


Fig. 8

in a fire box and so arranged that only the stamped sections are exposed to the action of the hot gases, the drawn portions being subjected to a much lower temperature, while the threaded ends are placed outside the fire box shell, vide C C, Fig 8. The several elements are joined together by return bends connected to the threaded ends of the pipes by means of nuts. The figures given by Sennett for the tube dimensions are, for the smaller sizes, 2½ in. exterior diameter by .39 in. thick, up to 3¼ in. in diameter and ½ in. thick. The width of the water space varies from .04 in. to .12 in. The amount of water that can be contained in the tube is very small in proportion to the weight of the tube itself. Thus the 2½-in. tube, weighing 9 lbs. per foot, contains little more than 1 oz. of water per foot run.

The weight of the Serpollet generator, which is also used with slight modifications on the Le Blank steam omnibuses, is a disadvantage for road locomotion. The thick tubes are essential; otherwise the pressure would fall considerably each time water was injected. On the other hand, some 30 minutes or more must be taken for the purpose of heating the coils at the start. The boiler is most ingenious and efficient and has had a great popularity abroad.

Some experiments have been tried at Liverpool (England) with a flash boiler having the tubes flattened by a V-shaped die applied in a succession of strokes acting across the tube. The tubes would then appear with a succession of dents alternately, as A and B, Fig. 7. In this boiler the plan was adopted of threading the return bends with a slightly different number of threads to the inch than those on the ends of the tubes; hence by this differential screw the bends and tubes could be drawn together with great force and still use strong coarse threads.

COIL GENERATORS.

Recently in The Horseless Age we have seen an eminent professor mention coil boilers. The present writer does not

know how old this may be in connection with automobile study and practice, but in hunting up material I have come across a controversy of the earlier part of the century that leads to the opinion that the principles of coil boilers, capillary and otherwise, had received such consideration and experiment as the state of the art would permit at that time.

In 1824 some experiments were made by one Joseph Buchanan on a light coil boiler. The money and facilities to carry on his work seems to have been advanced by other interested gentlemen whose names are not given. Buchanan published a lengthy report of his investigations both in the London as well as the American Mechanical Magazine about midsummer of the above year. Buchanan was an American, according to the above journal, and he goes into the discussion of the capillary steam engine with minuteness and care:

"A small capillary generator was constructed and applied to a small engine. The tube used for the generator was made of copper and was ⅛ in. in diameter. At different times we put into the fire from 5 to 40 ft. in length. The apparatus was so small that we could not arrive at any very conclusive results. We satisfied ourselves, however, that the scheme was practicable and that a copper tube would answer for a generator. We then made arrangements for constructing an engine on a large scale, calculated for 4 h.p., and as we still believed that it could be applied to aerial navigation we aimed at lightness in all its parts. The generator was formed of a copper tube, ¼ in. in diameter and 100 feet long, and weighed 16 lbs. The steam cylinder was formed of sheet copper, was 3 in. in diameter, 27 in. stroke and weighed with all its appendages about 25 lbs., the whole, when put together, weighing about 115 lbs. Upon trial we found the generator was coiled up too compactly to admit the application of sufficient fuel, and that the force pump did not supply sufficient water.

"An opportunity of accomplishing the necessary alterations was presented by Mr. Jackson, a manufacturer, at Nicholasville. The engine was applied by him to run his cotton factory, which was previously worked by three horses. The engine runs at the rate of 40 double strokes per minute and steam is cut off at the middle of stroke. The generator now contains about 120 ft. of the tube, most of which is ¼ in. in diameter. It is arranged in coils, one above another, in the form of a sugar loaf, 30 in. high, the bottom coil being 18 in. in diameter and the top one considerably less. The wood is prepared as usual for stoves and put within the coils, the lower end resting on a hearth a little below the generator, which is inclosed in a brick furnace. One cord of woods lasts two days and a half—at the present season about 36 hours. The water enters at the top of the generator and comes out in steam at the bottom. By using a geater quantity of tube and placing more of it over the fire in the ascending hot gases and at the same time raising the steam to 200 or 300 lbs. to the square inch and cutting off earlier it is manifest that a much greater economy might be effected. Mr. Jackson condenses the steam by two old still worms, which are kept cool with water pumped by the engine from a well. The waste is supplied by rain water. This is indispensable in a limestone country, for the lime is deposited in the tube and quickly fills it if lime water be used. The current washes out all other impurities, the lime deposited being as white as snow. The generator and main cylinder, with their contents and appendages, exclusive of fuel, need not weigh more than 20 lbs. to the horse-power."

The report ends with a general recital of the advantages for river navigation and concludes:

"It will also be found applicable to land conveyance. Its lightness and compactness will admit of its being used for propelling wagons, of heavy burdens on turnpikes and railways, and stage wagons on all good roads."

Note that the passage of the water and steam through a narrow opening at high pressure is relied upon to keep the tube comparatively clean, as in the Serpollet generator of modern engineering. It is also notable that Buchanan admitted the feed water at the top of his generator and the cool water passed down toward the source of heat, exactly in the same manner adopted in the well-known Herreshoff steam boiler for yachts and torpedo boats. A description, with dimensions, of this latter coil boiler may be found in Thurston's Manual of Steam Boilers. The objection to most coil boilers is the difficulty of repairing them inexpensively. This is a matter for the designer, who may perchance get over this without sacrificing some advantage elsewhere.

HOT WATER WAGONS.

It has been proposed to store hot water, under compression, on a vehicle and to operate the motor by utilizing the heat capacity of water, which latter is heated to a degree sufficient to obtain the steam necessary for working the engine. I do not have space to go fully into the subject of hot water motors and will briefly state that so far as the writer is aware the first hot water engine was brought out by Dr. Laurin, of New Orleans. Mr. Francq bought the patent rights and improved the system. Mr. Farman has a lengthy description in his work on "Autocars," from whence I derive the following summary:

"The principle of the Francq locomotive is the storage of water under pressure at a high temperature, which can supply steam when that pressure is diminished. The hot water engine is based on the principle of stored power, similarly to the electric and compressed air cars. In short, the hot water reservoir is nothing less than an accumulator of heat used to convert this water into steam, which acts upon the piston and transforms the stored energy into actual work on the shaft.

There are losses with this accumulator as with others due to radiation and to the expansion of steam which takes place without doing useful work. In fact, the steam expenditure in the stationary boilers required for reheating the water in the hot water tanks amounts to about 55 lbs. per horse-power per hour, involving a consumption of 7.7 lbs. of fuel.

The consumption of an ordinary locomotive would only be about one-half of the above. This system is therefore not an economical one compared with ordinary steam engines, but when compared with other systems of traction—with electric or pneumatic accumulators—we find it is as good, if not better."

General Data on Steam and Fuel.

By A. H.

Steam is but a convenient carrier of heat, which is the most common form of energy known. Man's wisdom ends with the sun, and it is generally accepted that it is sun energy that makes things move and that was instrumental in creating the vast stores of heat found in coal, peat and wood. Just as we speak of volts and amperes in electrical matters, of pounds pressure and gallons in hydraulics, so we measure the intensity of heat in degrees by means of thermometers and express its quantity in heat units.

For the benefit of those who study foreign books on the subject we may say that water has the greatest density at (40 deg. Cent.) 39½ deg. Fahr.; boiling point (100 deg. Cent.), 212 deg. Fahr., and that one heat unit (the quantity of heat necessary to raise 1 lb. of water of 39½ deg. Fahr. through 1 deg. Fahr.) corresponds with 0.252 calories, one calorie being required to raise the temperature of 1 oz. of water 1 deg. Cent.

The "specific heat" of any substance or the capacity of heat, as we might call it, is the number of heat units required to raise the temperature of 1 lb. of that substance 1 deg.

Since it is evident that a body charged with heat can be used as a source of heat if we suitably connect it with a mechanism transforming this heat into useful work, we see that in making steam we must use bodies of great specific heat (heat retainers, such as brick, clay and asbestos) to surround the fuel in our furnace; bodies of small specific heat (copper, steel, etc.) to hold the boiler contents and separate them from the fuel, and finally, some liquid of great specific heat to convert into steam. Some have tried alcohol instead of water, expecting to get better results from a boiler using this, but it is clear that since it only takes seven-tenths as much heat to heat water as is required to heat alcohol, the latter will weight for weight represent less heat than heat water.

It is true alcohol or any volatile spirit will have a slight advantage over water, considering that it requires less latent heat to transform it from the liquid molecular state into the gaseous state, but on reflection the reader will see that there is nothing to be gained by the substitution of any other substance for water in the generation of steam. In many cases where other substances are used it is merely with the object of evading the law regulating the use of steam boilers.

One pound of the best Welsh coal may be said to have a heat value of 15,000 units, vaporizing 3 lbs. of water at 212 deg., while oil may have a heating power of 20,000, inasmuch as 778 foot-pounds are equivalent to 1 B. T. U. we have

$$\frac{15{,}000 \times 778}{3{,}000 \times 60} = 56 \text{ h.p. hours, theoretically obtained from}$$

burning 1 lb. of coal. If we could obtain even 1 h.p. hour from 1 lb. of coal, therefore, we should then have an efficiency of only 17 per cent., a figure which is still too high for the average steam engine, which gives an efficiency of from 8 to 12 per cent.

Heat and mechanical energy are subject to the laws of the transformation of energy, and any relation of the two can always be expressed mathematically in a formula.

In converting water into steam we can accurately watch the process, which is the commonest application of the laws of thermodynamics.

We first introduce into the water a certain number of heat units to raise its temperature to that of 212 deg. This heat for obvious reasons we call sensible heat. When this point is reached we know that the tension in the molecules of water becomes greater than that prevailing in the surrounding space and the water begins to boil. It is evident that we must supply heat (latent heat) to effect this change of molecular state. Furthermore, we must add (latent heat of expansion) heat if the steam has to do outside work.

Looking at Thiegner's table of saturated steam we find that at one atmosphere (15 lbs.) pressure—212 deg. Fahr.—the sensible heat figures with 79.58, the latent heat with 497.05, and the latent heat of expansion with 40.10.

At five atmospheres (75 lbs.) pressure—302 deg. Fahr.—we have these figures, with 152, 455.92 and 44.16.

At 10 atmospheres (150 lbs.) they are 181.24, 433.87 and 45.95.

The inference to be drawn from the aforesaid is that since it takes a total of 652.08 calories to generate steam of 75 lbs. per square inch, and a total of 661.061 calories to generate steam of 150 lbs., we should, to work economically, never use low pressure. We see from the aforesaid that introducing another nine heat units, or only 1½ per cent. additional heat, we double the pressure of the steam and greatly increase its capacity to do expansive work.

In addition to high pressure, dryness of steam is an important desideratum. Wet steam causes great heat losses in the cylinder walls of the engine, and besides, is very troublesome in the working of an engine. Belleville showed in 1873 in a very simple manner how dry the steam of his boilers was. Turning on a nozzle of dry steam and a second nozzle issuing wet steam, it was noticed that while the dry steam remained invisible for some distance from the nozzle, the wet steam came out in clouds and streaks, due to the water lagging behind the hot vapor and forming white streaks. Many boilers which generate steam rapidly act like soda fountains, inasmuch as they prime and send out more water than steam. Such boilers, of small water surface and steam space, should be fitted with water separators and dry pipes.

Superheating of steam being one of the latest and most fascinating branches of steam engineering, a few remarks in reference to it will be in order. Actually the employment of superheated steam to increase economy is only a revival of what took place 50 years ago, when the excellent work of Hirn, Clark, Perkins and others was checked by the shortcomings of the packing materials, workmanship and lubricating oils of that time. Especially as regards the oil it is necessary to use a very heavy mineral oil, since animal or vegetable oil would carbonize under the great heat.

Steam, wet or dry, unless superheated, we call saturated steam, because water is still easily discernible in it and any heat added causes more steam to be formed from the boiling water or the "pressure to rise with the temperature of steam and water." In other words, every pressure of steam corresponds with one, and only that, temperature. If we introduce additional heat after all the water present has been evaporated, we can raise the pressure of the steam without necessarily raising its temperature, or we can raise the temperature without necessarily raising its pressure. Thus, while saturated steam of say 100 lbs. pressure will or may form water in a low pressure cylinder, superheated steam of that pressure will remain hot enough to form a dry exhaust.

The reason why superheating gives increased economy is chiefly that it increases the volume of steam greatly and without much cost, and it is the volume of steam we must always consider as corresponding with a certain amount of work performed in an engine.

Of course, to be effective, superheating should be carried out thoroughly, and not only by a few degrees. The exact temperature will always depend on the resources of the designer together with the requirements of the case in mind.

Foster & Co., piano manufacturers, Rochester, N. Y., have engaged space at the Madison Square Garden Cycle and Automobile Show, and will exhibit four steam carriages.

Advantages of Circulation.

By S. D. Mott.

Broadly a boiler which evaporates the greatest amount of water in the shortest space of time is, other things being equal, the best boiler. The "other things" must be determined largely by the object for which the boiler is made and the conditions under which it is to be used.

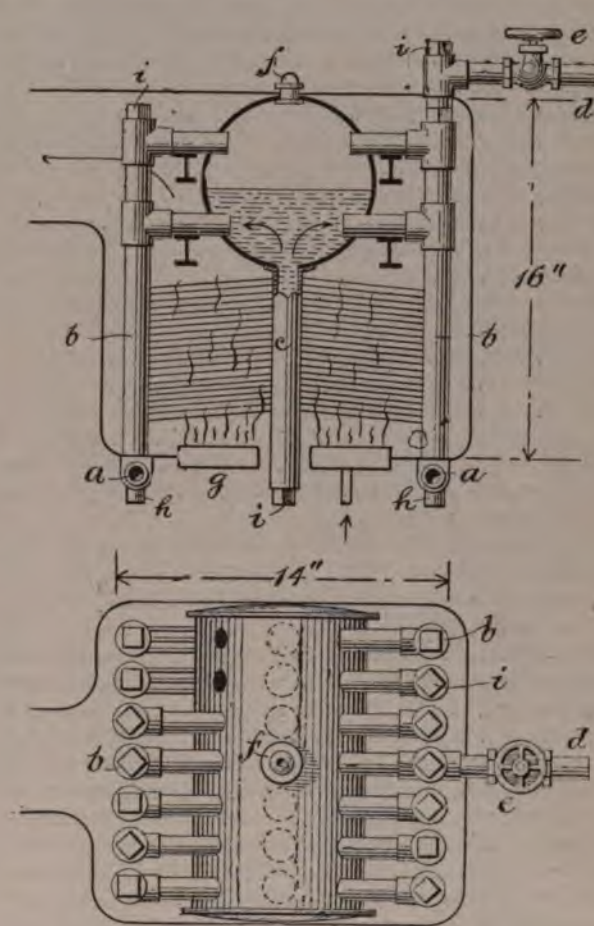
Heat is communicated from hot bodies to cold ones in three ways—by radiation, by conduction, by circulation.

If ice cold water is kept boiling at the surface the heat will not penetrate sufficiently to begin melting the ice at a depth of 3 in. in less than two hours. Practically then water may be considered a non-conductor of heat, though not entirely so. Its conducting power being low, heat is transmitted downward through water slowly, but upward it is transmitted rapidly solely by virtue of its circulation; hence the importance, among other things, of the point of application of the heat and incidentally a consideration of the steam boiler from the writer's point of view.

We have all noticed the tea kettle on the kitchen fire, the contents rising tumultuously around the edges of the vessel and tumbling to the center it descends to rise again. These currents, to be sure, are being impelled by the acquired temperature, for water, like most substances, expands when heated, and if mobile will rise. When water is heated to the boiling point, each added unit of heat converts a portion—about 7 grains in weight—into vapor, greatly increasing its volume, and the mingled steam and water, rising rapidly, produce the ebullition or boiling in the tea kettle on the kitchen fire. This condition of affairs can be depended upon to continue constant so long as the quantity or increment of heat continues constant, and the kettle will perform its proper function. If, however, the fire be quickened the upward circulation will interfere with the downward circulation and the kettle boils over, wasting its substance and caloric by dissipation, a very uneconomical proceeding for the kitchen tea kettle or the steam power generator. In the latter case, however, it is detrimental and may be dangerous to the machinery by what is technically known as foaming in the boiler and priming or boiling over into the engine.

If we take a glass test tube containing water and hold it vertically in an alcohol flame until it becomes heated throughout, the interference of currents just described when ebullition commences will be so marked that the water will be ejected violently almost like the flash of evaporated water from the spheroidal state. If, however, we imagine a vessel rounded at the bottom like the test tube, say 10 in. in diameter, and placed therein was a smaller vessel of the same shape 6 in. in diameter, open at the bottom, thereby dividing the contents so that they will not interfere each with the other, the rising column going up the sides and continuing down the center (Perkins' invention, 1831), we have no interference, but a free circulation. With this concentrically arranged double vessel we can quicken the flames to any extent without the possibilty of its boiling over. A perfect type of boiler, though not necessarily the best for all purposes.

Specifically, then, in what way does this apply to the steam power generators of commerce or steam generators for road vehicles? Circulation may be a good thing, but, to the point, what is its object, and why may we not leave this to the unassisted action of nature, as we do in the culinary operation on the kitchen fire? We may, if we do not care for the most important aims in boiler construction, namely, efficiency, safety, durability and quick steaming advantages, each of which is more or less dependent upon the continuous and uninterrupted flow of water within the containing vessel. As for efficiency, we have seen one proof in the tea kettle. When means were provided to preserve the circulation it was found we could withstand a hotter fire and boil away the water much more rapidly than before; and we also notice that when there



aa—Intakes. bb—Uptakes. cc—Downtakes. d—Outtake. e—Throttle. f—Safety Vent. gg—Heaters. hh—Blow-offs. ii—Screw Plugs.

was nothing but unregulated circulation the rising steam carried away so much water by foaming that the tea kettle boiled over, and on the other hand, as noted when circulation is perfect, this ceased and a much greater amount of steam was delivered in a dry condition for useful york. Hence, it is evident that circulation increases the efficiency in two ways—it adds to the ability of the water to take up the heat and decreases the liability to waste the heat.

There is yet another important way in which the efficiency is increased by circulation, and that is in preventing the formation of chemical deposits in the boiler. Most water contains

impurities which, when the water is evaporated, remain as a residuum and incrust the surface of the metal. In some parts of the country the incrustation from impregnated water becomes so serious a matter as to almost prevent the transmission of heat through the metal to the water. The presence of scale and sediment results in loss of fuel, breaking and cracking of the metal, predisposes to explosion and compels frequent repairs. It is recorded that 1-16 in. scale means a loss of 13 per cent. of fuel; ⅛ in., 25 per cent.; ¼ in., 38 per cent., and ½ in., 60 per cent. The Railway Master Mechanics' Association estimates that the loss of fuel, extra repairs, etc., due to incrustation amount to an average of $750 per annum for all locomotives in the Western and Middle States. The waters of New Jersey are remarkably free from the important mineral constituents of boiler scale, such as carbonate of lime, sulphate of lime and carbonate of magnesia.

Another advantage gained by circulation is durability. This is secured by maintaining all parts at a uniform temperature as near as may be. By uniform temperature freedom from unequal strains is secured. By far the most prolific cause of explosions is the strain from unequal expansion, and this leads to another important factor—safety. Durability and safety are almost synonymous terms in this case, because a boiler which is not subject to unequal strain of expansion and contraction is not only less liable to repairs, but also to violent rupture, all of which insures a long and useful life.

From what has been said, it will at once be observed, Mr. Editor, that a steam boiler has one at least of the characteristics of a printed publication, in that it is a good asset for its owner provided it has a good circulation; and he who runs may read that a live boiler has many analogous qualities to a healthy human being.

The question of the strength of materials for boilers was elaborately tested some years ago by the Franklin Institute. It was then found that the tenacity of boiler plate increased with the temperature up to 550 deg. Fahr., at about which point the tenacity began to diminish as the temperature rose. At 32 deg. Fahr. the cohesive force of a square inch section was 56,000 lbs.; at 570 deg. it was 66,500 lbs.; at 720 deg. it was 55,000 lbs.; at 1,050 deg. 32,000 lbs.; at 1,240 deg. 22,000, and at 1,317 deg. 9,000 lbs. Copper follows a different law and appears to be diminished in strength for any increase in temperature. At 32 deg. Fahr. the cohesion of copper was found to be 32,800 lbs. per square inch section, and exceeds this cohesive force at any higher temperature, the indications being that the square of the diminishing strength keeps pace with the cube of the increased temperature. Strips of iron cut in the direction of fiber were found to be 6 per cent. stronger than when cut agross the grain. Welding was found to increase the tenactiy of the iron, but welding together different kinds of iron was not found to be favorable. Overheating was found to reduce the ultimate strength of plates from 65,000 to 45,000 lbs. per given section, and riveting of plates was found to diminish the strength one-third.

To summarize: First—A boiler should be carefully proportioned to the work to be done and then, when working at its rated capacity, it will be operating at its highest economy.

Second—The water space should be such as to prevent too sudden and great fluctuation in water level, for obvious reasons. It is less necessary that the steam space should be large than that the flow of steam and its pressure should be uniform; in locomotive boilers the proportion of steam space per cubic foot of water evaporated does not usually exceed one-fifth of a cubic foot per cubic foot of water evaporated. A good average rule is that the steam space should be at least ten times the cubic capacity of the cylinder of the engine supplied.

Third—An adequate water surface, so that the steam may be readily disengaged from the circulating water, in order that foaming of water in the boiler and priming of the engine may be prevented.

Fourth—A sectional construction is preferable so as to avoid general explosion; the disruptive and destructive effects being confined to the escaping contents of the weakened or defective section. This is also a factor in cheap construction.

Fifth—Sediment blow-off cocks at the lowest points, and preferably removed from direct action of the heat and out of the direct circulation, to remove impurities deposited.

Sixth—Good material and workmanship, a simple structure, and of such placement as not to be liable to strains or stress of metal, with, of course, an excess of strength over any nominal pressure, together with compactness and accessibility for cleaning and repairs.

The relative rapidity or steaming qualities of the different types, according to the best authorities, stands: Water tube, 100; vertical fire tube, 60; horizontal fire tube, 55; flue, 25, and plain cylinder, 20. The relative economics of the respective types do not present so great a divergence.

With the idea of quick steaming qualities, cost, economy and adaptation in view. I have schemed a water tube boiler made of ordinary piping. It is, as clearly shown, made of tubes either all iron or wrought steel or wrought steel and copper joined and coupled together in any preferable manner. It would not be too much stretch of the imagination to call this form of boiler a cross between the flash or instantaneous generator and the plain cylinder types. The sketch will be understood without special description. There are 896 small uptakes, 7 large uptakes and 14 large downtakes properly proportioned. If the small uptakes are ¼ in. diameter there will aggregate about 40 sq. ft. of heating surface, sufficient to supply a 4 h.p. engine, the average for a runabout vehicle, in a space of 14 x 14 x 16 in.

Since the above was written, in a paper by Engineer-in-Chief George W. Melville, U. S. N., read before the Society of Naval Architects and Marine Engineers, entitled "Causes for the Adoption of Water Tube Boilers in the United States Navy," the following excerpt appears:

"The fact that water tube boilers raise steam quickly is of the greatest advantage. I have stated elsewhere that I consider the battle of Santiago to have developed the necessity of the use of water tube boilers, whether it taught us anything else or not. It would have been of the greatest advantage to have had during the blockade of Santiago boilers capable of raising steam in less than half an hour. Coal need not have been used to keep all the boilers under steam all the time. The Massachusetts might have shared in the glories of the fight if she had been fitted with water tube boilers. The Indiana would have kept up with the Oregon and the Texas. The New York would have developed at least 3 knots more speed and the navy would have been spared a controversy. I think the Colon would not have gotten as far away as she did. But we did not have the water tube boilers."

There is not much doubt in the mind of the average disinterested engineer that steam agency for propelling automobiles is the best so far produced, and in the opinion of the writer it will have the ascendency for the next few years and until the boiler, its weight and the weight and bulk of water necessary therefor will be superseded by kerosene as a motive agent used in conjunction with a simple compact combination of structural parts, which will be developed in the not distant future.

Efficiency of Small Boilers—Resistances.

By A. M. Herring.

The very great flexibility of the steam engine, where the point of cut-off and the initial or boiler pressure may be varied, makes it an exceedingly valuable engine for certain kinds of automobile work.

Small steam engines, however, are generally very wasteful of steam unless they are triple expansion or compound. Simple high pressure engines of less than 5 or 6 h.p., roughly speaking, can be counted on to use from 45 to 60 lbs. of water per brake horse-power per hour on less than full load and from 36 to 48 lbs. per horse-power hour when working full capacity. To supply the steam for, say, 5 b.h.p., unless we wish to run to extreme limits of minimum weight, there is not a great deal of choice between the tubular (boiler composed of tubes filled with water) and the shell boiler with tube flues. One thing, however, is important in a preliminary design, and that is to remember that the surfaces exposed to the flame evaporate much more water when across the draft than along it.

In tubular boilers, if we measure the whole outside area of the tubes exposed to the flame and hot gases, an evaporation of from 12 to 15 lbs. of water per square foot of surface may be had if proper natural circulation of the water in the tubes is possible and a good blue flame is used. If there are not direct and unrestricted routes along which the hot water may rise and the cool water descend and take its place to be heated—i. e., if there is not free circulation induced by the heat or mechanical means—but little more than 6 or 7 lbs. of water may be evaporated per square foot of heating surface.

If, on the other hand, ample means be provided for separating the water and foam from the steam generated and the water be made by mechanical means to circulate against the hot surfaces of the boiler at a high rate of speed, as much as 72 lbs. of water can be evaporated from 1 sq. ft. of surface. This the writer has succeded in doing in some experimental boilers for a flying machine. Such high rates of evaporation are, however, never economical in fuel, for it requires about 1 lb. of gasoline or 1¼ lbs. of vaporized kerosene to every 4½ to 5 lbs of water, against an evaporation of from 10 to 14 lbs. of water for the same fuel where the boiler is not forced to over 15 to 18 lbs. evaporation per square foot.

The great value of mechanical circulation in the boiler can be easily understood by an experiment. Suppose we let a little water drop on a very hot stove. We will see the bubbles dance over the surface for quite a while without wetting the surface. This is due to the formation of a film of vapor, which clings both to the bubble and to the stove lid, and this film has a very high resistance to the passage of heat.

At a slightly lower temperature of the iron this film is not formed rapidly enough to keep the water out of contact with the metal, and as the liquid clings to the metal with much greater force than its vapor and is at the same time a far better conductor of heat, we see the water almost instantly evaporated.

In the steam boiler a precisely similar action occurs, where the circulation is poor. The steam first formed clings in numerous bubbles to the hotter parts of the heating surfaces and practically puts a majority of the most efficient parts of the boiler out of action; but where the circulation is rapid or forced, these films are broken through as fast as formed and the water keeps the plates thoroughly wet and therefore absorbs the heat as fast as it is conducted through from the flame.

MATERIAL AND THICKNESS OF BOILER SHELLS.

As the heat conducting power of copper is about twice that of iron or steel, one would naturally suppose that a much smaller boiler would do for the same power if made of copper than if made of iron or steel; but such is not the case. Nor does it make any material difference after a boiler has been in use a few times whether it have tubes an inch thick or 1-100 of an inch thick in so far as evaporation is concerned. The reason for this lies in the fact that the main resistances to the passage of the heat from the fire to the water are not the resistances offered by the metal itself, but are due to a film of air or burnt gas which clings to the metal on the furnace side, or, more probably, to the soot or metal oxide on the furnace side, and also to a similar (but less) resistance which the heat encounters in forming on the water side. Consequently, when all three resistances are added together the resistance of even the thickest plates of steel in use for boilers is so small that it amounts generally to less than 1 per cent. of the resistance offered by the air and vapor films.

Automobile Generators Under the Law.

By Perry B. Rawson.

SAFETY THE PRIME FACTOR.

In the installation of all steam generators for land and marine purposes the paramount consideration is safety.

The law of the land demands this one qualification—safety.

Boiler inspectors appointed by both Federal and local governments care nothing about the cost, type, style, economical operation or other details of boilers they inspect. Their business is to determine by a thorough and scientific examination of material, workmanship and conditions of operation the ultimate strength of the generator to resist rupture.

When this has been ascertained, the appointment of a high factor of safety generally insures a safe working pressure.

These inspections are repeated periodically and have reached such a high state of perfection that when honest and competent men are employed the users of steam, their employees and the public are protected to a degree approaching absolute security.

Beyond the requirements of safety, what restrictions has the law placed upon the operation of steam boilers? None of any importance. In some localities it has been seen fit to abolish the smoke nuisance by prohibiting the use of bituminous coal and fatty woods, but nearly all other precautions, such as rigid examination of boiler attendants, proper setting of boilers, two methods of introducing feed water, fusible plugs, periodical cleaning, etc., are in the interests of safety.

These facts show, if one pauses to reflect upon them, that the item of safety should receive the first and most careful consideration in the construction of automobile boilers.

To individual builders who intend to handle their production themselves, no appeal should be necessary. The desire to secure freedom from personal danger will cause the majority of this class to err on the side of a too high factor of safety.

On the other hand, many manufacturers (honorable and conscientious though they may be) will, in the desire to market their goods, answer the mad clamor of the inexperienced public for light weight, cheapness, low cost of operation, etc., by turning out generators in which the element of safety has received little if any consideration, and borders on the danger line.

To prevent this state of affairs it should suffice to remind manufacturers, and individual constructors also, that when an element of danger is present in articles or substances much used, and the general public does not possess the means or the inclination to guard itself against possible accident, it is customary for the law to step in and appoint itself guardian of the public safety. In view of this fact, the subjection of automobile generators, one and all, to the same regulations as stationary and marine boilers, will undoubtedly take place before long throughout the Union.

Signs of this move are already visible in some States.

When it does come it will mean thorough inspection of every steam vehicle which makes use of the highways and city streets.

The question then will not be, "How much does the boiler weigh?" or "What does it cost per hour to operate?" but "Is the boiler capable of working at the desired pressure with safety?"

Boiler inspectors take nothing for granted. Neither are they partial to low factors of safety, and unless a few points are "stretched" in their favor many of the vehicle boilers now in use will be either totally condemned or have their allowed working pressure considerably reduced.

Many steam users of to-day cry out against the red-tape methods and over-strict regulations. When automobile boilers come under the law's jurisdiction a more pronounced outcry will be heard, as the people directly affected will belong to the ranks of the general public and will not be in sympathy with the motive and good intentions of the law.

This should not be the case, and if the manufacturers will take warning in time, the public will be saved trouble and disappointment.

There is nothing unreasonable in the demand made; the authorities do not seek to suppress; they endeavor to bring within the bounds of safety. They do not say whether iron, steel or copper shall be used, or whether a boiler shall be round, square, oval or oblong, provided it has sufficient strength.

Safety is surely a reasonable demand, and if inventors and manufacturers can be made to realize now that this should be their first thought in designing a boiler to comply with the law's demands, their productions will not be found wanting when the test comes.

All the vehicle boilers so far noticed by the writer are furnishing steam at high pressure. This practice need not be departed from, for if at commencement the determination is made to construct boilers which can be advertised, sold and guaranteed to "carry high pressure with safety" rather than to be "the lightest weight steam generator ever produced," there should be no difficulty in achieving the desired result.

Records of many years of boiler practice are open to investigation. The same troubles which beset land and marine boilers are to be guarded against in vehicle boilers, with a few additional ones from which the former are free.

A most important point is the selection of proper material. The best that money can buy is none too good.

If the item of safety is kept fully in mind, due regard will of course be given to thickness of same.

The relative merits of shell and tube boilers is a much discussed topic, but where high pressure is to be carried the balance of favor is overwhelmingly with the latter.

One danger which should receive a greater amount of attention than it has is incrustation, which has a bearing not only upon the operation of the boiler, but upon the life of the boiler. When we consider that all of the solid matter contained in feed water, both in suspension and solution, is left in the boiler after its evaporation into steam, and when the extremely dangerous effects of this deposit are so universally known, it is surprising that in vehicle boilers more thought is not bestowed upon remedies for this evil.

A liberal use should be made of sediment pockets and blow cocks, which would allow of the boiler being "blown" and "washed out." If tube boilers are designed so that a rapid circulation is maintained, and sediment pockets are placed in the correct positions, most of the solid matter will be deposited in the pockets, from which it may be blown at intervals. In very thin tubes, such as are used in many of the tube boilers now seen, a very slight incrustation will induce burning, and in tubes of a very small internal diameter complete choking sometimes occurs in a remarkably short time.

In boilers of the flash type a feed water filter of some description is advisable.

Fusible plugs may not be considered necessities on vehicle boilers, but one of these valuable adjuncts might some time prove its usefulness, always remembering, of course, to make the fusible composition of conical shape to prevent the steam pressure from blowing it out.

In conclusion, I would call attention to the fact that in many States the law requires two methods of boiler feeding to be provided.

Even though this should not be made compulsory on automobiles, it is to be commended, as frequently a pump or injector refuses to work.

Proper attention to these and other details upon which the law has seen fit to impose its supervision, coupled with an intelligent application of well-known mechanical principles, should result in the production of a steam generator suitable for automobiles which possesses above all else the most requisite qualification of them all—safety.

Considerations in the Design of Vehicle Boilers.

By P. M. Heldt.

One of the questions that are almost invariably asked by the prospective purchaser of an automobile is: How long does it take to get ready for a run? A vehicle which is ready at any time to be started at a moment's notice has certainly one very strong point in its favor, and in certain lines of work this quality is practically imperative.

In considering a design for an automobile boiler we must therefore, first of all, look for a construction which reduces to a minimum the time required in the operation, the equivalent of which in stationary boiler practice is known as building fire

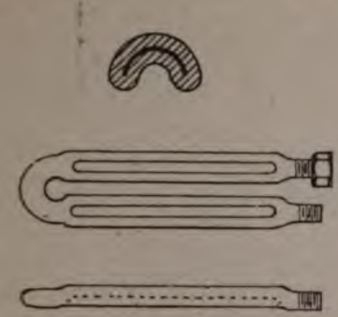


FIG. 1

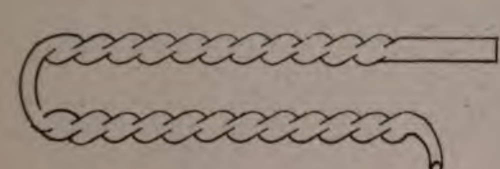


FIG. 2

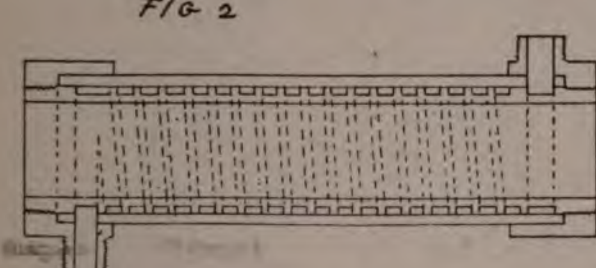


FIG. 3

and raising steam. In all forms of stationary boiler a large quantity of water has to be raised to the temperature of steam at the working pressure before any steam of this pressure can be drawn from the boiler. This necessarily requires a large amount of heat, and considerable time elapses before all this heat can be supplied, especially as the effectiveness of the fire is low at first.

For pleasure vehicles, and, in fact, for all others, with the possible exception of the heaviest freight vehicles, which require two men to conduct, liquid fuel is to be preferred, on account of its convenient storage, cleanliness, and on account of the better control of the burners as compared with a coal or coke fire. Liquid fuel burners permit an automatic regulation of the fuel supply in proportion to the steam taken from the boiler.

To avoid the necessity of raising a large amount of water to a high temperature while raising steam, we have to make our boiler of such a form that, although having a large heating surface, the quantity of water at any time in the boiler is very small. This is one of the considerations which have led to the general adoption of the water tube type of boiler for motor vehicle work. The importance of this consideration was fully recognized by early workers in this field, and the requirements for instantaneous steam generation have probably never been better satisfied than in the Serpollet generator, one of the earliest and most successful types that have been applied to road locomotion.

The earlier form of the Serpollet boiler consisted of sections in the form of a U—that is, tubes running once back and forth through the combustion chamber. These sections were connected outside the combustion chamber by means of U-shaped fittings fastened to the sections by union couplings. Two views and a cross section of these tubes are given in Fig. 1. As will be seen from the drawing, the tubes are pressed into a peculiar shape, which is intended to best satisfy the requirements of a large heating surface, together with little water space and large resistance to the deformation of the tubes. M. Serpollet must have found, however, that the resistance to deformation is not sufficient at the high pressures common in this class of work, for in his latest type of boiler he has changed the form of the tubes, as shown in Fig. 2, which is part of a section of his latest construction. As will be seen from the figure, the tubes are flattened and twisted. He has also greatly reduced the number of sections—that is, the number of joints—by using, instead of sections running back and forth through the combustion chamber once, sections which run back and forth a number of times. As tubes of this form are easily burned when subjected to an intense heat, the tubes directly over the burner flame, through which the water flows when first entering the boiler, are of full circular cross section. The upper sections of tubes, which serve the purpose of superheating the steam, are also of full circular cross section.

The tubes generally employed in tubular boilers are of steel, but of late many inventors have tried to substitute copper tubes for these. It is a well-known fact that copper has a much higher thermal conductivity than steel or iron, and that as a consequence there is considerably less loss of heat with the former than there is with the latter. There is, however, one objection to the use of copper tubes for this purpose. The tensile strength of copper is only from one-third to one-half the tensile strength of steel at ordinary temperature, but at the temperature to which boiler tubes are subjected in practice the tenacity is much reduced. I quote here some figures from Wilson's "A Treatise on Steam Boilers," showing the diminution of the strength of copper at various degrees of temperature.

Temperature Above 32 deg. Fahrenheit.	Diminution of Strength.
270	.0926
460	.2133
532	.2558
660	.3425
812	.5581
1000	.6741
1300	1.0000

Aside from its greater conducting power, copper has the further advantage over steel of not being so liable to oxidation, either from impurities in the feed water or from the action of the heat, and that most forms of boiler sediment do not adhere to it very firmly, this latter fact being of value as facilitating the cleaning of the tubes.

As a result of the many advantages of copper for boiler tubes, various attempts have been made to overcome the difficulty of its weakness. As an example of these may be mentioned the boiler used in the Stanley steam carriages, which consists of copper tubes surrounded with steel wire. The steel wire shields the copper from the intense heat of the flame and takes up the greater portion of the stress due to the expansive force of the steam.

Perfectly dry or superheated steam is an essential in automobile work, as it leads to greater economy both in feed water

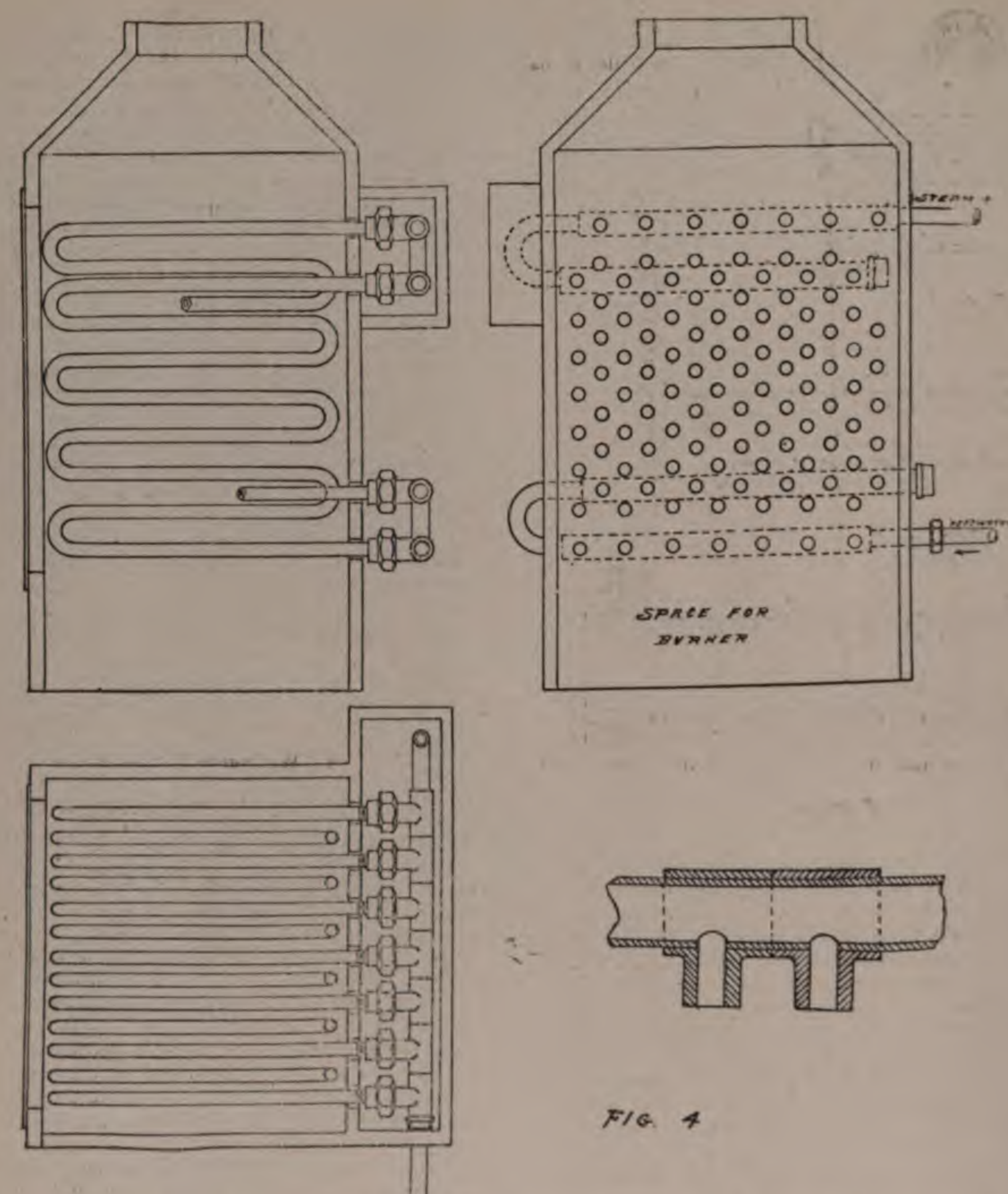


FIG. 4

and fuel and is required for satisfactory operation of the engine. To effect the superheating of the steam it is necessary to impart additional heat to it after it is out of contact with the water. If the boiler is of such a construction that the water fed to the boiler and the steam developed from it have to pass through a great length of pipe or a large number of small sections connected in series, the steam may be superheated without any special provisions; but if the boiler consists of short sections of tube connected in parallel, the steam should be led from the junction of these sections to some part of the combustion chamber, where it may receive the additional heat. The usual place for the superheating tubes is above the regular boiler tubes, where the hot gases pass into the chimney.

It was stated above that one of the reasons for the almost universal adoption of water tube boilers is the desire to obtain a large heating surface with little water capacity in the boiler. Another very important reason is the fact that water tube boilers are not liable to disastrous explosions, as is the case with shell boilers. Makers of steam vehicles usually designate their boilers as non-explosive, and as this term is often misunderstood by laymen, a word of explanation may not be amiss. This term does not imply that the tubes of a tubular boiler will not give away under any of those abnormal conditions which are required to produce an explosion of shell boilers. Indeed, the bursting of tubes in tubular boilers of the fire engine type is not an altogether unknown occurrence. It does imply, however, that the bursting of a tube is not ac-

companied by the same disastrous results that usually follow the rupture of a shell boiler. The only damage which can result from the giving out of a tube in a vehicle boiler is that due to the escape of the scalding steam; but as the amount of hot water in the boiler is very small, the pressure would drop at once and the steam then issue with slight force.

With the high pressures at which vehicle boilers are operated it is, of course, not an easy matter to make a perfectly steam tight joint. Joints in the tubes are liable to give more or less trouble, and for this reason they should be reduced in number to the least possible. This latter consideration has led to the coiled tube and return bend tube types of boiler. The joints should not be located where there is an intense heat, and they should preferably be placed entirely outside of the combustion chamber. The design of the joints should be such that they will not be affected by the vibration to which the boiler is subjected on the road, yet allow of easy disconnection in case burned or damaged sections have to be replaced. The sections of the tubes should be so arranged with regard to each other that any one can be withdrawn and replaced without disturbing any of the rest.

A boiler which deserves mention as being of entirely different construction, yet presenting the same advantages as the ordinary tubular boiler, is the Kecheur boiler, made in France. This boiler contains 24 sections, each section consisting of two concentric steel tubes, the larger one fitting tightly over the smaller one. There is a burner for each section, which is placed inside the tubes. The inner tube has on its outer periphery a rectangular spiral groove which runs into a circular groove near the ends of the tube. The inner tubes are somewhat longer than the outer ones, and circular nuts screw on to the inner tubes at the end to hold the outer tubes in place. These nuts are bored out to a larger diameter for part of their length, and this part fits over the outer tube. The nuts have a radial projection, which, when the former are in place is right over the circular groove near the end of the outer tube. These projections are threaded and bored and serve to connect the different sections.

In the Kecheur boiler, the same as in the Serpollet, the tubes are first brought to a temperature of about 500 deg. Fahr. before any water is injected into the boiler. When this temperature has been attained water is pumped into the boiler by hand, which immediately turns into steam, and the vehicle is ready to start. It is claimed for this boiler that, the burners being located inside a long tube insures a good draft and perfect combustion; but it would seem that the evaporative efficiency of this boiler is rather low on account of the flame passing along the heating surface instead of impinging upon it from below. The multiplicity of the burners is another disadvantage. A section of the Kecheur boiler is illustrated in Fig. 3.

Fig. 4 is a sketch illustrating some ideas as to how to embody the greatest number of the foregoing requirements or desirable features in a vehicle boiler. The boiler consists of sections of steel tube, bent so as to run back and forth through the combustion chamber. These sections are united by manifolds or distributing pipes, the construction of which is shown in section in Fig. 4. T fittings of wrought iron or steel are finished so as to slip over a steel tube. They are then braced on to this tube and holes are drilled through them into the tube. The steel tubes of the boiler are inclosed in a rectangular shaped casing of sheet iron lined with asbestos to prevent a too free radiation of the heat. The tubes are located in the middle of the casing, the lower part being left free to receive the burners, while in the upper part a superheating coil can conveniently be located. All the pipe connections are outside the combustion chamber. The connections at the upper ends of the sections are covered by a special asbestos-lined casing fastened to the main boiler casing in such a manner as to be easily removable in case of repairs having to be made. The connections at the lower ends of the sections might also be advantageously covered, but an insulating lining is here of no use. On the side of the boiler opposite from where the connections are made there is a door in the casing which is large enough to leave any section tubes pass through. No means are shown in the drawing to rigidly attach the tubes to the boiler casing, but provisions to attain this end should, of course, be made.

In fixing the dimensions of a boiler of this form it will be seen that the proximity of the tubes horizontally is limited by the unions, which must be far enough apart to get at any one with a wrench, while all the rest of them are in place. The proximity vertically is limited by the smallest curvature to which the tubes can be bent. The different sections should be placed as indicated in the drawing, so that the tubes of one are staggered with regard to the tubes of the other. When thus spaced the flame on being reflected from the surface of one tube will impinge upon the surface of another, and thus produce a much greater heating effect than if allowed to pass up directly between rows of tubes.

Shell or Water Tube Boilers?

—By Wellington P. Kidder.

During my twenty-three years' practical experience as a mechanical engineer, I have found few subjects in the arts of greater importance than steam generators.

While I prefer not to be considered an expert, I may perhaps contribute without technicalities some information of value, especially to those who may have taken up but recently the study of steam boilers best adapted to motor vehicles.

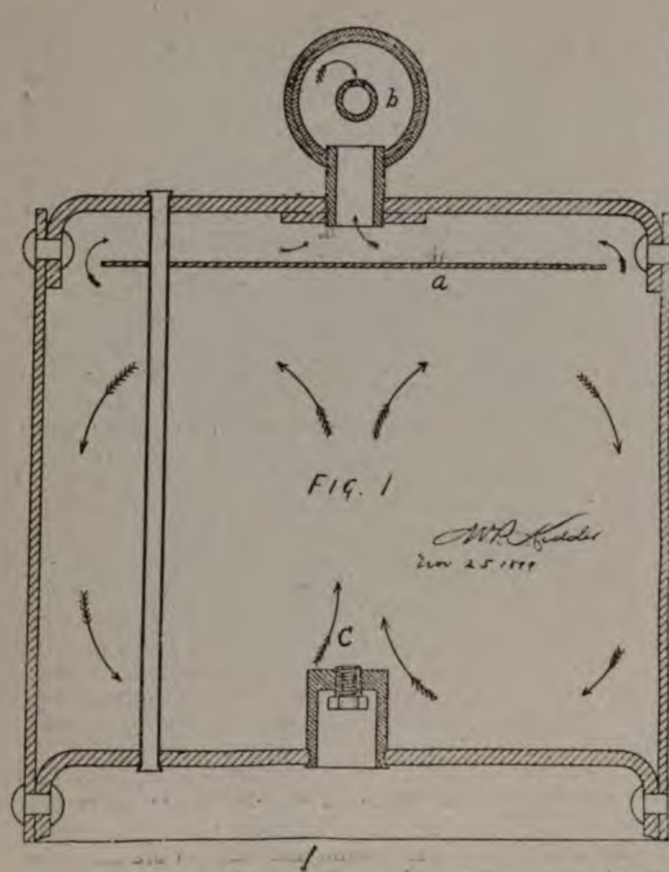
Of prime importance is the matter of safety. Without an approximate certainty of securing this, experimenters in steam would better turn their attention to other subjects. It should not be possible for dangerous boiler explosions to result from any degree of carelessness in their use.

The choice of a type best suited to motor vehicles will doubtless lie between the upright tubular (shell) and the water tube. The former may explode, although when properly designed and constructed of best material, and in good condition, the danger is very remote. A leading advantage of the water tube boiler is in its non-explosive character. At most only one or more of its tubes may break, as it has no pressure shell. The breakage of tubes in a small water tube in the open air, if properly encased, need have no dangerous results.

The leading merits and demerits of these two forms of steam boilers may be profitably compared.

I submit in Figs. 1 and 2 designs for an upright tubular to carry 200 lbs. working pressure.

Shell 55,000 lbs., test fire box steel boiler plate, ¼ in. thick, 16 in. diameter by 16 in. high. Head and crown sheet, same material, ⅜ in. thick, containing 325 copper tubes ½ in. diameter, No. 18 Stubbs gauge, 14½ in. long, embracing about 50



sq. ft. of heating surface, developing 5 h.p. Breaking strength of this boiler, over 1,200 lbs. pressure to the square inch, limited in use by the safety valve to 200 lbs., thus having the factor of safety of 6, this factor being the requirement of the United States marine law. A shell 3-16 in. thick in a boiler of this diameter, with heads ¼ in., should be reinforced at points of pipe connections and not allowed to carry above 150 lbs. working pressure.

A baffle plate, a, and a separator, b, insure dry steam to the engines. A fusible plug, c, melts if the water is too low, releasing all pressure from the boiler while there is still sufficient water to protect the crown sheet from excessive heat, and also from the chill of cold water.

In this type of boiler the water circulation is as shown by the large arrows, the steam rising over the baffle plate as the small arrows indicate.

Such a boiler is compact and symmetrical, affording ample external surface for all pipe connections including gauge cocks, water gauge, steam gauge, safety valve, inspirator, pump, blow-off, fusible plug and steam supply.

As regards durability, the weakest point in all well proportioned upright tubular boilers is the crown sheet. This plate, next to the fire, is gradually incrusted on the inner or top side with a scale and deposit of non-conducting material, often due largely to impurities in the water, thus separating the water from contact with the metal. This permits overheating and weakening of the metal, besides impairing its quick steam qualities. For these and other sufficient reasons an entire new boiler should be substituted as often as every five years. The fact that some boilers last for ten or fifteen years before they explode is not a sufficient reason for neglecting this precaution.

In an acceptable water tube boiler:

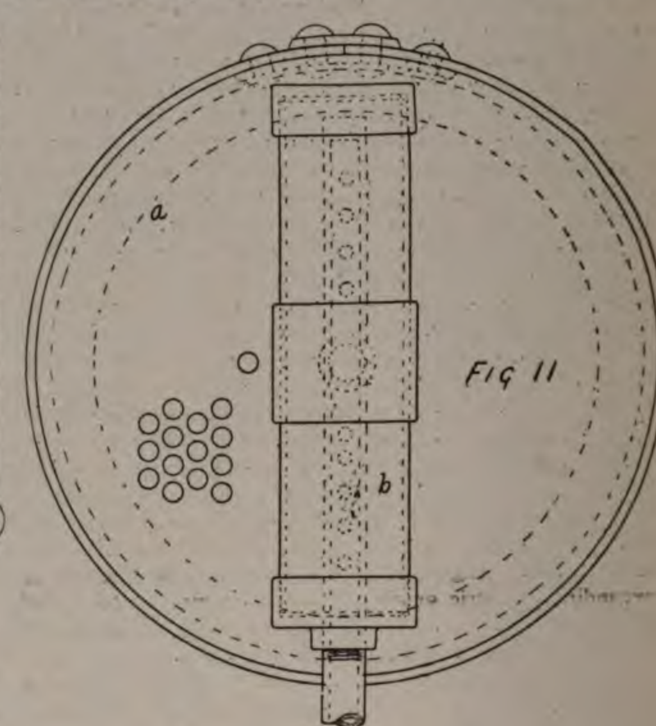
First—The water should not be expelled by excessive heat from the tubes nearest the fire.

Second—Foaming and priming should be no more likely to occur than in shell boilers.

Third—There should be no joints in the fire.

Fourth—There should be few parts, easily and cheaply assembled.

Fifth—The weight should not exceed two-thirds that of a shell boiler of equal capacity.



Sixth—The boiler should be in sections, each section easily accessible for renewal or repair without disturbing other sections.

Seventh—An easily removable casing should properly confine the heat around the tubes and also safely deflect downward to the ground any escape of water or steam in case of the breakage of tubes.

Eighth—A natural and rapid circulation of water and steam through all the tubes should be insured.

Ninth—Special and ample provision should be made for insuring dry steam to the engines.

Tenth—It should always be convenient to blow steam through the tubes for cleaning and around or between them for removing accumulations of soot.

Such a steam generator, of copper tubes, should possess the following advantages:

First—All danger minimized.

Second—Steam more quickly generated.

Third—Weight minimized.

Fourth—More heat is absorbed against inclined than against vertical tubes.

Fifth—More heating surface on exterior tubes.

Sixth—Less accumulation of dust.

Seventh—Higher working pressure of steam practicable.

Eighth—Better elastic provision for expansion.

Few, if any, designs for water tube boilers thus far known are believed to be satisfactorily adapted to motor vehicles. The chief difficulties lie (a) in too much bulk and complication, (b) liability of foaming and priming, (c) danger of excessive heat of tubes next the fire, caused by the water being so quickly expelled by conversion into steam.

Boiler Feeding Apparatus.

By R. I. Clegg.

The amount of water to keep up the supply in the boiler can be introduced in any one of several methods and may be capable of regulation in equal variety. It is desirable that the supply of water to the boiler shall be automatically controlled, for the demand upon the steam generator constantly varies and the controlling agency, if regulated by hand, is either wasteful of water or often perilously near burning the boiler. Nor can the most careful operator but take chances when handicapped by conditions interfering with a view of the gauge glass. A vehicle of minimum weight may not be quite so susceptible to road variations as a heavier one; nevertheless the addition of a purely automatic feed water regulator is a highly desirable feature. Some of the complaints coming from owners of steam carriages who have found it impossible to obtain as high economy in their use as has been claimed by others are reminded that this lack of economical results may possibly be traced to the desire of the tyro to avoid all likelihood of danger to the boiler by the general practice of maintaining a high water level. This reduces the opportunities for accident if the operator shall forget his whole duty in the matter, but, on the other hand, the high water level means the liability to carry over into the cylinders hot water—priming, as it is usually known. Economical results from either engine or boiler under such circumstances are not to be expected.

The majority of steam vehicles employ hand regulated devices. The pump, generally of the plain plunger type, may have its stroke lengthened or shortened by a suitable link or expanding eccentric or pin. The suction may be controlled by a plug cock or any other valve. Either plan will serve, the latter having the merit of greater simplicity.

If the valve closing the suction pipe be nicely fitted so as to rotate with very little effort, then the valve stem may be connected with a float acting upon the surface of the water in the boiler and the rising or falling of the float will lessen or increase the supply, as the exigencies of the case may require. This is exactly the plan adopted in the Cross steam carriage, as follows:

From the steam drum in top of boiler a pipe is run horizontally outside the boiler casing, thence downward by an elbow and nipple to the float chamber. This last is a light iron casting in cylindrical form, with hemispherical ends. A hollow projection on the side has at its outer end a bearing for the light rod attached to the hollow copper ball which moves up and down in the chamber. A small spindle passes out from the side of float chamber through a packing gland and bears at the outer end a balance lever connected directly to suction plug lever. From lower end of float chamber a pipe goes down and into one of the lower boiler tubes. A glass water gauge is placed on side of float chamber but is not used while carriage is in motion—indeed, it cannot be seen from the driver's seat.

Very probably the fact that an ordinary thin copper ball is considered untrustworthy for such a purpose by many engineers may be productive of doubt as to the dependence worth placing upon such a contrivance. It is well known that such balls for high pressure service require strengthening, and if this is done by thickening the shell or adding ribs, loose or attached, to the internal or exterior surface, the buoyancy of the float and its consequent available power for useful work is thereby diminished. Mr. Cross has hit upon a plan of strengthening the float without appreciable addition to the weight of the ball, and as the "kink" is not generally known, it may here be given the publicity it merits. The method is simplicity itself, and consists in the injection of a liquid into the ball prior to screwing the float on to the stem. Mr. Cross prefers some volatile oil, as gasoline or naphtha—a couple of spoonfuls in a ball about 2½ in. in diameter being sufficient for the purpose. Plain everyday water would also serve, the idea, as will be readily understood, being to withstand the exterior pressure by an equal and of course opposite pressure in the ball. And here a word of warning is imperative: Remove the ball when testing boiler with cold water—the hydraulic test—otherwise the ball, lacking the potent aid of the interior pressure, will in all probability collapse and become worthless.

In practice the above device works well. Many long rides in the evening or night have been taken, and the apparatus has thus far justified the reliance placed upon it.

Messrs. Piper & Tinkham have in their steam carriage adopted an arrangement concerning which full details are lacking. The general scheme may be said to consist of an intermediate tank placed between the boiler and the water supply reservoir. A link worked from countershaft reciprocates and rocks a lever to and fro, which, in turn, actuates the mechanism in the middle chamber. The internal arrangement of this last has not been publicly explained so far as we are aware, and we, as in other cases of reticence, compare the device with what is known of other similar appearing mechanism. These plans for getting water into boilers against pressure by the use of an intermediate chamber are not novel save in some matters of detail. Several of the more suggestive patents are here depicted, the sketches in most cases having been redrawn from the patents with a view to showing particularly these features most likely to be of service in automobile design.

Fig. 1 is an arrangement embodying the main features of United States patent No. 16,662, steam boiler water feeder, A. J. Vandegrift, Feb. 17, 1857.

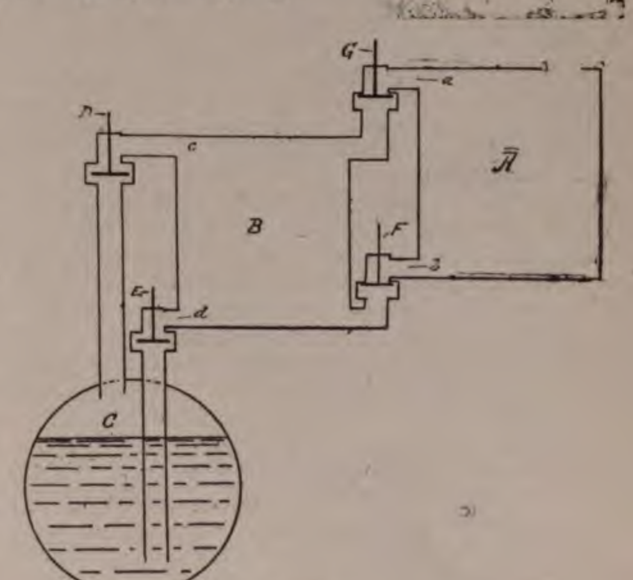


FIG. 1

The specifications of this patent are not now for sale and there may be other noteworthy features in the claims, but so far as it goes Fig. 1 is fairly representative of many later attempts of a like nature and purpose.

A represents the supply tank, B the intermediate chamber and C the boiler. D, E, F and G are valves opening and closing the passages a b and c d, as required. The inventor uses a rotating cam shaft to operate the valves in set, viz., D E open and close together, as do F and G, but D E act also alternately with F G.

Let any amount of water be in B and the valves D E be opened to communicate with C, the chamber B will obtain the boiler pressure and by gravity the contained water will pass through d to the boiler. D and E are now closed and the valves F and G are opened, the cold water condenses the steam in B, or as much of it as fails to pass through d into the atmosphere, and by gravity, as before, B is again prepared to replenish the boiler.

Superficially the patents do not seem to lay claim to any automatic feature that could be relied upon to keep a permanent water level. Fig. 2 makes an effort in this line. This is essentially the steam boiler water feeder invented by N. Puckett—No. 26,374, Dec. 6, 1859.

In Fig. 2 A is the boiler and B is the intermediate chamber, having the passages connecting with the boiler and b attached to supply tank. The passages a b communicate alternately with the cavity c in the slide valve C.

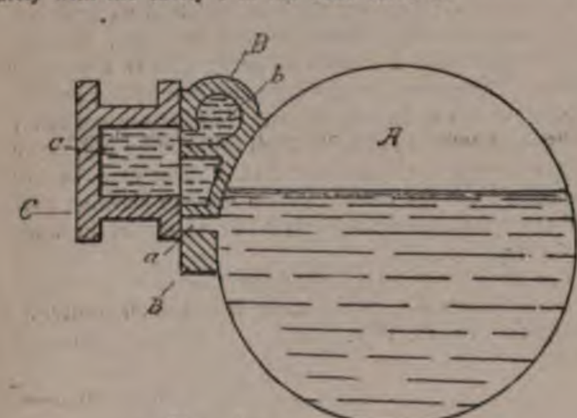


Fig. 2.

Suppose the valve C has a regular motion up and down the face of B; when in the position shown c fills with water from b; now the valve C moves down, covering the passage b and opening the passage a to the boiler A, the water level in c dropping to that in A. Evidently if that process is continued the water level in A tends to rise until level with highest point of cavity c, when just opening the passage a. As far as the writer can ascertain this patent forms the groundwork of several methods mentioned with considerable show of secrecy in connection with steam propelled vehicles. In his drawings the inventor shows a single tooth cam, means for attaching the device to boiler and for taking up wear and possible leakage around the valve. As these objects may be sought by different avenues it has been deemed best to give the essential and valuable features only.

Fig. 3 has a like object to the previous one, but is obtained by a different arrangement of the mechanism. It was devised and patented Aug. 4, 1868, and is numbered 80,536, improvement in automatic boiler feeders, Samuel Driver, of Philadelphia. The device consists of an automatic boiler feeder, so constructed and arranged in relation to the feed pipe and boiler as to convey the water from the former to the latter at regular intervals and keep up a regular height of water, the apparatus consisting of two receivers, arranged vertically with each other and having their communication with each other and with the feed pipe and boiler, each opened and closed alternately by means of revolving valves, whose shafts have an intermittent gearing, with a central shaft, which is driven by the steam engine or intermediate shaft.

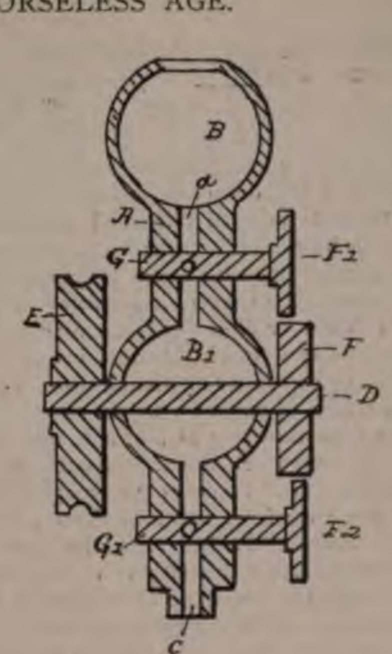


Fig. 3.

Fig. 3 is a vertical section through the device. A is a casting with chambers B and B1 and a communicating passage, a. The feed pipe, which is not shown in the drawing, has communication with the chamber B by means of the opening, with which one end is connected, and the chamber B1 has communication with the supply pipe by means of the passage c. D is a driving shaft provided with stuffing boxes, and on one end is a pulley, E, which, by means of a belt, has connection with the driving shaft of engine or an intermediate shaft. On the other end of D there is a wheel, F, which has two series of teeth by means of which it has an intermittent gearing with the pinion F on the projecting end of the rotary valve G, which communicates with the passage A.

There are two other series of teeth in another line of the wheel F, which have a like intermittent gearing with the pinion F2 on the projecting end of the rotary valve G1.

The operation is as follows:

As the shaft D revolves by means of the series of teeth above mentioned, it has an intermittent action respecively on the valves G and G1 through the pinions F1 and F2 so as to open and close the passages a and c alternately.

Consequently, when the passage a is closed above the valve G and the valve G1 being open, the water in the chamber B1 descends into the boiler and steam will take its place, and before the valve G is opened the valve G1 is closed, as rep-

resented in Fig. 3, to cut off the pressure of steam from the boiler. And when the valve G is opened the water presses forward from the chamber B and feed pipe and condenses the steam in the chamber B1 and takes its place. The alternate action of the valves is thus kept up, and the supply pipe communicating with the boiler at the water line, the regular depth of the water is maintained.

In Fig. 1 the connection to the several tanks is shown as duplicated, the scheme taking cognizance of bringing the steam pressure upon the surface of the water with as little interference as possible with the descent of the supply of water into the boiler. As will be seen, this is not readily accomplished but by a double pipe, and the old inventor fully understood the situation as far as the present writer can ascertain. The double connection to boiler is objectionable on several grounds and attempts have been made to obtain like results with but a single entrance to the boiler. One of these is shown in Figs. 3 and 4. These figures represent patent No. 533,803, boiler feeder, Feb. 5, 1895, Moses Gregson, of Philomath, Ore. As this is representative of several ideas brought to our notice, a description is here given covering all details of importance:

Fig 4 is a section side elevation of Gregson's improvement and Fig 5 is a plan view of the same.

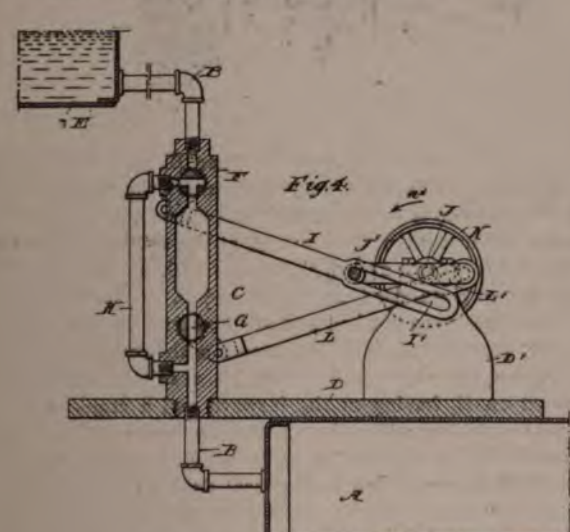


Fig. 4.

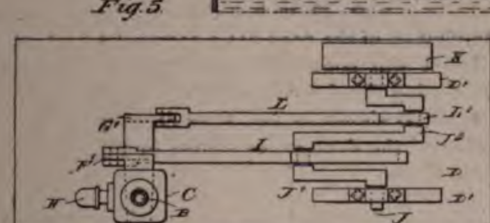


Fig. 5

The boiler A is provided with the supply pipe B, in which is arranged, a suitable distance above the boiler, a casing, C, as is plainly shown in Fig. 4, and supported on a framework, D. The upper end of the supply pipe B is connected with the water tank E, so that the water can flow by gravity through the pipe B and its casing C to the boiler A, to fill the same.

In order to regulate the quantity of water passing from the supply tank E to the boiler A, he provides two valves, F and G, in the said casing C, the valves being arranged to alternately open and close, so that when the valve G is closed and the valve F is open, water can flow from the tank E into the casing to fill the same between the valves F and G, and then the valves are reversed—that is, the valve F is closed and the valve G is opened, as shown in Fig. 4, to permit the water in the casing to flow through the lower end of the feed pipe B into the boiler A.

In order to cause a ready flow of the water from the casing C to the boiler A, he provides the steam pipe H, adapted to connect the bore of the casing C, below the valve G, with the valve F, which, for this purpose, is preferably made as a two-way valve, as indicated in Fig. 4, and when in a closed position it connects with the upper end of the pipe H, so that steam can flow from the boiler to the supply pipe B into the lower end of the casing C, and through the pipe H and valve F upon the top of the water contained in the casing C, so as to equalize the pressure on the top of the water, and to permit the same to flow, by its own gravity, through the open valve G into the boiler A.

In order to alternately operate the valves F and G at stated intervals, the following mechanism is provided: The valve stem F′ of the valve F is connected with a pitman, I, having a slot, I′, engaged by a crank arm, J′, formed on a shaft, J, journaled in suitable bearings on standards, D′, of the frame D. The shaft J is provided with a pully, K, connected with suitable machinery for turning the said shaft at a certain rate of speed, governed by the amount of water needed for the boiler during a certain length of time. The valve stem G′ of the other valve G is likewise connected with a pitman, L, having a slotted end, L′, engaged by a crank arm, J^2, likewise secured on the shaft J and extending in an opposite direction to the crank arm J′.

When the several parts are in the position shown in Fig. 4, and the shaft J, in rotating in the direction of the arrow a′, acts by means of its crank arm J^2 on the pitman L so as to close the valve G, then the other crank arm passes loosely through the slot I′ until the crank pin of the crank arm J′ finally moves against the outer end, so as to exert a pull on the pitman I, to open the valve F. Water can now flow from the supply tank E through the upper part of the supply pipe B into the casing C, to fill the same above the closed valve G. On the further revolving of the shaft J the crank arm J^2 first acts on the pitman L, to move the valve G into an open position, and then the crank arm J′ acts on the pitman I so as to close the valve F by moving it into the position shown in Fig. 4. Communication is now established between the valve F and the pipe H with the boiler, to equalize the pressure on the top and bottom of the water contained in the casing C, so that the water now flows by its own gravity through the open valve G to the boiler. The above described operation is then repeated on the further revolving of the shaft J—that is, if the valve G is closed, the valve F is opened and a measured quantity of water passes in to the casing C, to be then discharged to the boiler as described. It will be seen that by this arrangement a measured quantity of water is fed into the boiler without requiring a pump, injector or other forcing device.

The device makes no pretension to automatic ability to maintain the water level in the boiler at any predetermined point, but as it covers several items concerning which inventors in this line stumble over occasionally, an attempt is made in this summary to anticipate and answer some queries that may have a likelihood of being propounded. In this

essential feature of a steam generator there are several types not here considered, since they have not, to the knowledge of the present writer, been used or even suggested in connection with automobile work.

Another gravity boiler feeder is the one patented May 30, 1893 (No. 498,397), by John N. Leach. The inventor is president of the Leach Motor Vehicle Co., Everett, Mass., and the device is in use on the motor carriages made by that concern.

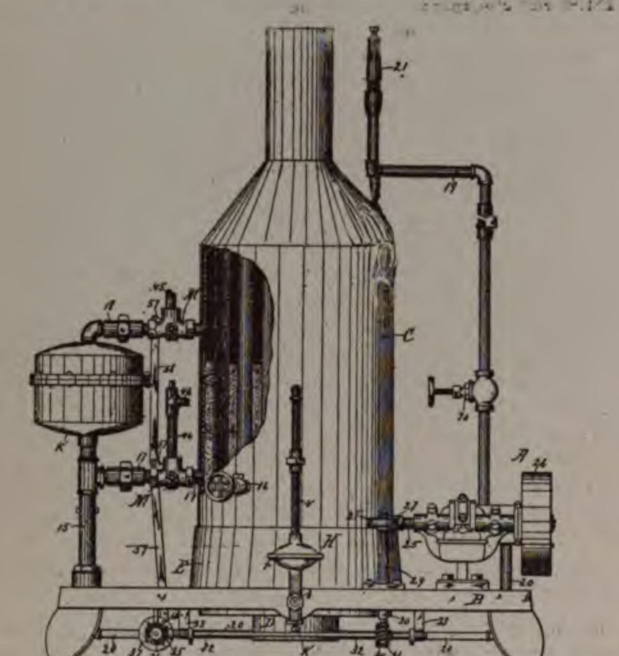


Fig. 1

Fig. 1 is an elevation of a steam engine and vertical boiler showing Mr. Leach's improvement in use; Fig. 2 a front elevation of the feed tank and connections enlarged, one of the valves being shown in vertical longitudinal section; Fig. 3 a horizontal section of one of the valves; Figs. 4 and 5 vertical longitudinal sections of the same showing the valve in different positions assumed.

In the drawings A represents the horizontal engine of ordinary construction, which is mounted upon a stand, B. Centrally a vertical tubular boiler, C, is also mounted.

The application of the device is shown in its adaptation to engines in which oil is employed as fuel, a burner of any suitable construction being disposed below the fire box E of boiler.

At the side of the boiler opposite the engine A a vertical pipe, 15, is secured, serving as a standard for supporting the feed tank K, which is located at the normal water line of the boiler. Adjacent to the blow-off cock 16 the boiler is tapped below its water line by a horizontal pipe, 17, which connects it with the pipe 15, the lower ends of the pipe 15 being plugged. An automatic valve, M, is interposed in the pipe 17; a similar pipe, 18, connects the top of tank K with the boiler above its water line and an automatic valve, M', of like construction, is also placed in the said pipe.

The boiler is tapped by the steam supply pipe 19, connecting with the engine A, and a throttle valve, 70, is interposed. A safety valve, 21, is connected with the supply 19. The exhaust

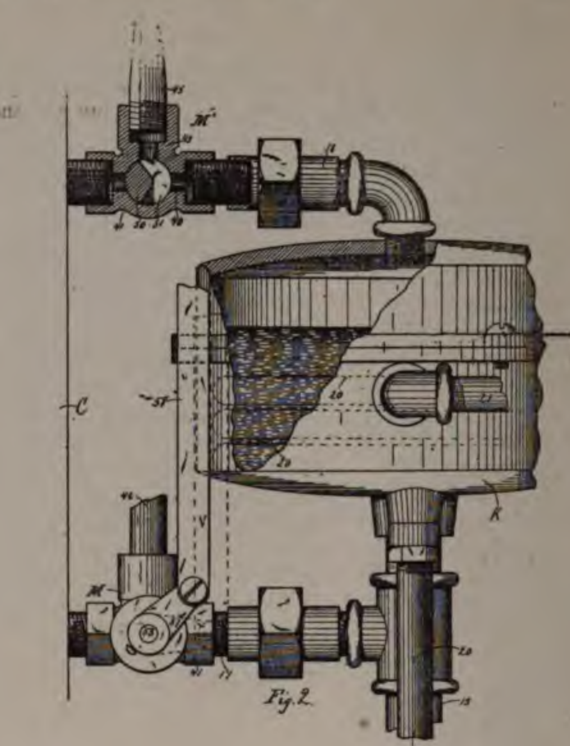


Fig. 2

pipe 20 passes down through the base B, and whence it is carried parallel with the pipe 15 and enters the bottom of the tank K. Pipe 20 is coiled in tank and opens out to any waste pipe for exhaust. On the shaft 25, at the end opposite wheel 26, there is a worm, 27, which meshes with a worm gear, 28, journaled on a standard, 29, in the bed B. A shaft, 30, from gear 28 passes over the bed and at lower end has a worm, 31. A worm gear, 34, on shaft 32, meshes with worm 31. A pinion, 35, on shaft 32, meshes with 36, a suitable shaft being mounted on B, having at the forward end a crank disk, 37, disposed vertically under the valve. The valve M has a two-way cock having a duct, 40, in its body, 41, connecting sections of the pipe 17 or 18. A vertical duct, 43, opens into the duct 40, and connects with the (in the case of cock M') tank exhaust pipe 45, leading to supply tank. The supply tank is connected by a pipe, 46, with a duct, 43, and the lower cock M. The plug 50 of the cock has a segmental port, 51, of such shape that it will connect the sections of the straightaway duct 40, closing the duct 43, as shown in Fig. 4, or close all of said ducts, as shown in Fig. 5, or connect the duct 43 with one section of the duct 40, as shown in Fig. 2, in a quarter

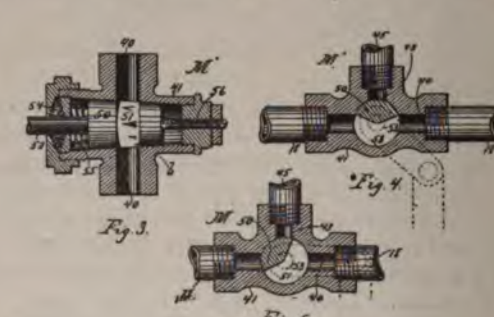


Fig. 3. Fig. 4. Fig. 5.

revolution of said cock. The cock is formed in the shape of a truncated cone, as shown in Fig. 2, its seat being correspondingly shaped. The steam 53 of the plug is packed at 54 (see Fig. 3) and between the packing nuts and plug a pushed spring, 55, is interposed, said spring tending to hold the plug tightly in its seat. An adjusting screw, 56, passes through the opposite end of the bed B and engages the smaller end of plug centrally, said screw being designed to force the plug sufficiently against the pressure of the spring 55 and prevent it from binding in its seat. A crank arm, 57, is secured to the outer end of each plug stem, 53, said arms on the cock M M' being connected by a rod 58, as shown in Fig. 1. A connecting rod, 59, connects the crank pin 60 of the crank disk 37 with the crank arm 57 of the cock M.

The worms, shafts and connecting rods form a reducing motion between the engine shaft 25 and the cock M M', these parts being so arranged and timed that the cock plugs are reciprocated one-quarter of a revolution in the form of engine shown once in three minutes.

In the use of this device, the valves being in the position shown in Fig. 2, the plug duct 51 connects the tank through the pipe 18 with the exhaust 45 in the cock M', and in the cock M connects the supply 46 with said tank through the pipe 17. The opposite ends of said pipes 17 and 18 adjacent to the boiler being thus closed, water from the supply tank passes through the pipe 46 into the tank K. The engine being started, the connecting rod 59 is drawn downward by the reducing motion until the plug at the end of a quarter revolution assumes the position shown in Fig. 4, closing the supply 46 and exhaust 45, and opening the straightaway passage through the pipes 17 and 18 between the boiler and the tank K. The water in the tank passes through the pipe 17 into the boiler. On the reciprocation of the plugs the arms 57 being driven upward by the connecting rod at an eighth revolution, the plug assumes the position shown in Fig. 5, closing the supply and exhaust pipes and the connection with the tank K. At the completion of the quarter revolution the plugs assume the position shown in Fig. 2, connecting the tank K with the supply and exhaust, 46 and 45, relieving the pressure therein and permitting water to enter the tank from the main water supply tank. The form of the plug port 51 enables the water to be fed gradually from the tank K into the boiler, the level in tank and boiler being continuously maintained.

The exhaust 20 of the engine A, being coiled within the tank K, and the discharge from tank being gradual, enables the water therein to become heated by the exhaust steam in coil and delivered to the boiler in such heated condition, effecting a great saving of fuel.

In regard to the use of injectors as automatic feeding devices for vehicle boilers, William Sellers & Co., Philadelphia, Pa., the largest manufacturers of injectors in the country, write:

Replying to your favor of the 20th inst. relative to the application of injector to steam automobiles, would say that we have supplied a few injectors for this purpose, but we do not think their use is as advantageous as the small pump, as the orifices of the size injector required are so small that they are liable to stop up and cease feeding.

There are patents now existing for the automatic regulation of the feed supply by an injector to a steam boiler, but we have not seen it applied to automobiles, and at present we do not think it practicable. Yours truly,

WM. SELLERS & CO. (Incorporated).

A Practical Method of Utilizing Exhaust Steam.

By Edwin Kilburn.

It has been the history of all new industries that in their development the more important principles were the ones first to receive consideration at the hands of inventors and experimenters. The automobile industry is no exception to this general rule, as, while great advancement has been made in the design and construction of all vehicles, particularly in those whose motive power is steam, there is at present a noticeable absence of those refinements which, though not absolutely essential to the successful operation of the vehicle, would contribute either to the economy of operation or to the ease of handling.

One matter which can with propriety be discussed at this stage is the utilization of the exhaust steam for the purpose of heating the feed water preliminary to forcing it into the boiler.

While some designers have made use of the exhaust steam for this purpose, the great majority do not seem to realize the great gain which can be made by the use of a properly designed feed water heater.

There are now in use three principal methods of feeding a boiler, viz., by some form of direct acting steam pump, by an injector and by a pump directly actuated by the main engine. For automobile use, especially in the light pleasure carriages, the last method is the one which is the most suitable.

Professor D. S. Jacobs, of Stevens Institute, gives the following table showing the relative efficiencies of the various systems both with and without feed water heaters, the feed water temperature being taken as at 60 deg. Fahr., steam pressure at 80 lbs, a direct acting pump pumping directly into the boiler being taken as unity:

Method of supplying feed water to boiler.	Relative amount of coal required.	Saving of fuel.
Direct acting pump feeding at 60 without heater,	1.000	.0%
Injector feeding at 150 without heater,	.985	1.5%
Injector feeding through heater heating from 160 to 200,	.938	6.2%
Direct acting pump feeding through heater heating from 60 to 200,	.879	12.1%
Geared pump run by engine, feeding through heater heating from 60 to 200,	.868	13.2%

It will be seen from the above that there is a very great gain in heating the water by the use of exhaust steam, although the total of 13.2 per cent. cannot all be credited to the heater, as the geared type of pump run by the engine is very much more economical than any form of direct acting pump.

It has been calculated by eminent engineering authorities that with feed water at an initial temperature of 60 deg. Fahr. and steam of 150 lbs. gauge pressure there is a saving of .0858 per cent. for every degree that the feed water is heated before being supplied to the boiler (I have taken the above temperature and pressure, as they seem to meet the general average in steam vehicle practice). Therefore, if by means of a well-designed exhaust steam feed water heater we can heat the water from 60 deg to 200 deg., we will save the difference between

60 deg. and 200 deg., or 140 deg., which, multiplied by .0858 per cent. saving for each degree, gives 11.91 per cent fuel saving by use of heater, or, looking at it from another standpoint, gives that much greater boiler capacity without any extra expense except for the heater and connections, and is besides very much better for the boiler, for feeding cold water is often the cause of otherwise unexplainable leaky tubes, etc.

We now come to the consideration of the different types of heaters. They are divided into two general classes, the open and the closed; but as the open type is not adapted to portable use we will not consider that further, but will immediately take up the closed type, made in many different styles, which usually come under one of the following heads:

The simplest style is the one shown in Fig. 1, consisting of the shell M, head X and pipe N. In this the exhaust enters at E and leaves at D, the feed water entering at A, passing through pipe N and leaving at B.

This style, when made of sufficient capacity, is quite efficient and, furthermore, possesses the advantage of being very easily repaired. By disconnecting the feed water pipe connections and removing the head through which the pipe N enters and leaves the heater, we are enabled to withdraw the same and easily make any needed repairs. The main disadvantage of this style is that it has to be very long to secure much capacity.

Fig. 2 is a development of the preceding type, the main difference between them being that instead of the water passing simply through the double pipe as in Fig. 1, it here passes through the coil or coils N, thereby securing a much greater amount of heating surface in the same space. This style of heater is sometimes made with a return coil, thus bringing the feed water inlet and outlet at the same end of the heater instead of at the opposite ends, as shown in Fig. 2.

Another type of heater in quite general use is that shown in Fig. 3, where, instead of either the two pipes or the simple coil for heating the water, we have a large number of tubes, N N N N, running through which the steam passes, and the water circulates around the outside of them from the inlet A to the outlet B, E and D being the steam inlet and outlet respectively. This is a very good type of heater, but I should not consider it as well adapted to automobile use as Fig. 2, as it is somewhat heavier for the same capacity. This style is also somewhat liable to get out of order by reason of the tubes starting to leak in the tube sheets Y. There is also at times a tendency for the water to take a short cut from the inlet to the outlet and not derive the benefit from the steam that it should, especially when the inlet and outlet are placed on the same side of the outside shell.

This type is sometimes used with the heating surfaces reversed so that A and B are the steam inlet and outlet and E and D the water inlet and outlet. In this way the water is compelled to pass over the heating surface, but we have the disadvantages of the comparatively large packed joints between the heads X and the main body M, and the heads have to be made much heavier to resist the increased pressure.

I think that Fig. 2 will be found the most generally useful for automobile use.

Besides the saving in fuel resulting from the use of a feed water heater, there is another very important reason for their use in many sections, and that is for removing impurities such as lime sediment, etc., from the water before entering the boiler. It is a well-known fact that many of these scale forming impurities may in a measure be removed by heating the water to nearly the boiling point and then providing a settling chamber where they will settle to the bottom and may then be blown off, thus preventing to a large extent the formation of scale in the boiler. This is a matter of even greater importance in some localities than the saving of fuel, as, unless some such device is adopted boilers will give a great amount of trouble from scale formation if the ordinary water of such localities is used, and it would be quite a task to always provide the boiler with rain water.

The heater should always be placed between the pump and the boiler, and not ahead of the pump, as the pump will work much more satisfactorily with cold than with hot water.

About 1 sq. ft. of heating surface should be used in the heater for each horse-power of the boiler.

I should like to hear from others on this subject.

Fig. 1

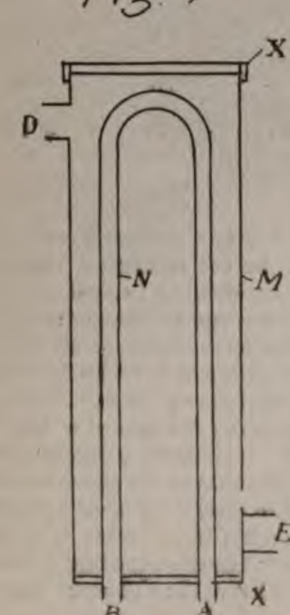


Fig. 2

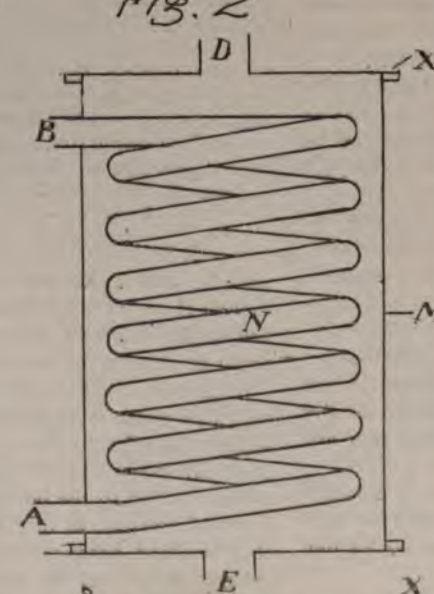
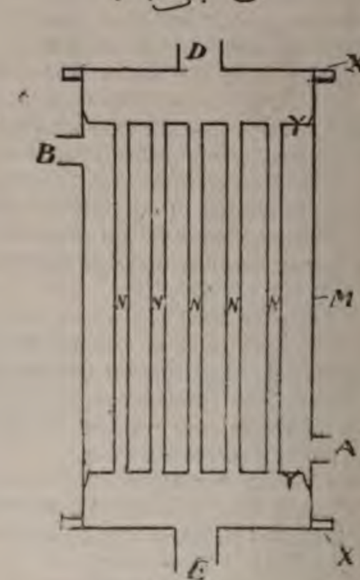


Fig. 3



Oil Fuel Burners.

By R. I. Clegg.

It is not the purpose of the writer to go into a lengthy consideration of the uses of petroleum and its products in the generation of steam. To those who desire further data as to chemical analysis and evaporative tests, etc., we may direct attention to Prof. Boverton Redwood's book on "Petroleum," Bryan Donkin's work on the "Gas and Oil Engine," the several mechanical engineers' pocket books and "Proceedings of the Institute of Mechanical Engineers (Eng.) for 1884 and 1889," as well as a great amount of information in the technical press.

In an accompanying article on the Locomobile opportunity was taken to describe the Stanley burner at some length, and here we may pass to three other representative types.

Each of the figures represents a vertical section through burner.

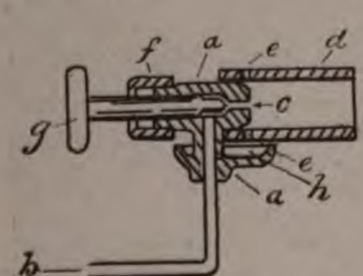


FIG 1

Fig. 1 is another type of burner for gasoline. Here a is a brass or bronze casting with a chamber communicating with the inlet pipe b; a is bored and threaded for the valve stem g and fitted to the tube d and stuffing box f; in d are drilled air holes, e e, and the lower part of a flares out at h into a cup.

The gasoline may be forced through b by pressure generated by an air pump, or the oil tank elevated 2 ft. or more above the casting a. Sometimes the casting a is made longer and f dispensed with entirely, or it may be modified in various ways, as a mechanic can readily see.

To start in operation, first get the air pressure; put about a teaspoonful of oil in h. Some put a piece of tow or waste in h and some content themselves by slightly opening and closing valve. The latter plan is likely to throw most of the oil through d and is not to be recommended. As soon as the oil burns out in h, open the valve and at once ignite the jet at the mouth of d, and thereafter the heat of burner will be sufficient to generate the oil gas.

This simple burner embodies the main characteristics of many complicated contrivances for the burning of oil. If the reader will imagine the pipe b being wound in a spiral around d prior to entering a, he will get a fairly good idea of the "Lucigen" or the "Wells" burner. The latter gets rid of the coil, strictly speaking, by connecting b with a chamber around d. In each of these and in many other devices founded on them, the oil is further volatalized by being brought in close proximity with the flame passing through the outlet tube d.

Fig. 2 is typical of the Rider, Cross, Shipman, Urquhart and other kerosene or crude petroleum atomizers or oil injectors.

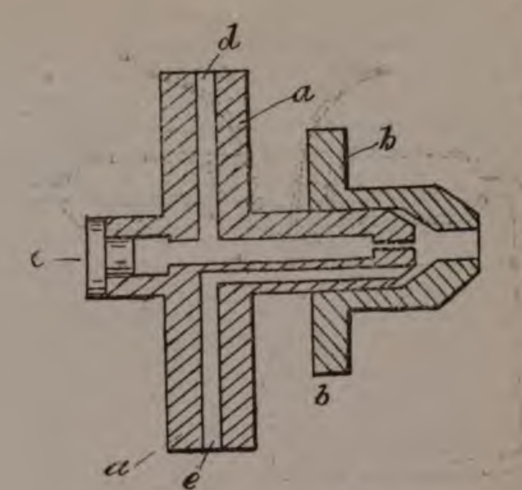


FIG 2

As before, a is the main casting threaded to receive the tapped cap b. The conical interior of b is of the same taper as the end of a, fitting therein. The opening d in a is piped to the highest point of steam boiler, to get dry steam, and the opening e is piped to oil reservoir; c is a plug, though sometimes a regulating valve is inserted here to cut off the outlet from d through a.

Let steam be turned on at d and oil at e; the former passes through b with great velocity, the jet sucking up and thoroughly combining with the oil. As the mixture passes out into a suitable furnace of cast iron or fire brick, a torch ignites the combination of oil and steam.

The supply of oil can be nicely adjusted by turning the cap b which by reason of the tapered seat regulates the passage of oil.

The Urquhart burner has an oil chamber surrounding the steam passage and the rotation of a steam pipe regulates the oil neatly. Drawings of this burner and sketches showing its application in locomotive practice are to be found in Low's pocket book.

If a regulator or automatic diaphragm be inserted between burner and boiler either on the Shipman (1884) or Stanley method, the burner will act inversely as the boiler pressure and the device is then self regulating. In the burning of the heavier oils it is found that considerable adjustment of the cap is even then necessary to obtain good and thorough combustion of the fuel. On the Cross arrangement an additional diaphragm is employed having a double chamber, one each side of the plate, and as the steam pressure on one side varies according to the steam regulating diaphragm, the oil is by a valve on the other side regulated to the amount that is necessary for efficient service. At a test at which the writer was present with the U. S. Supervising Inspector, Eastern District, the latter pointed out the safety of such a device, by cutting off the oil entirely when steam was shut off from the burner.

Fig. 3 is also used for burning the heavier oils. Here a is a circular hollow casting having an inlet, c, and an outlet, d. Above a is an inverted hollow cone, b, filled with fire clay. Under the influence of air pressure the oil passes from reservoir through c, where it is heated, and out at d, where it is ignited, and passes up and around a and b. The fire brick retains sufficient heat, it is claimed, to relight the jet coming

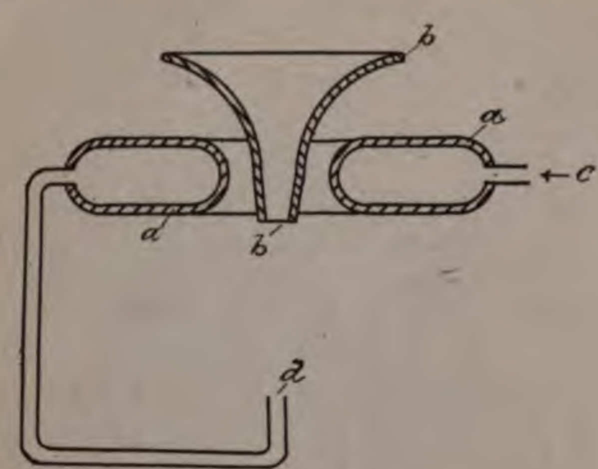


FIG 3.

out of d, if jet has been turned off temporarily. The arrangement here depicted is the one used by Mr. House in this country and the Liquid Fuel Engineering Co., of Cowes, England.

The House system does not require steam or compressed air to form a spray, as the oil vaporizes from its own heat. The burners, from their peculiar construction, become self igniting and self cleaning, and through these particular features they are safe to let run for an indefinite time without atttention. Water will often appear in oil used as fuel, and the aqueous vapor extinguishes all flame, and after it has passed out of the boiler the hydrocarbon vapor returns diluted with air, and superheated by the walls of the boiler it becomes explosive, and should there be a spark of soot remaining in the boiler the result might be disastrous; but through numerous experiments Mr. House claims he has succeeded in eliminating all danger from such cause. The

HOUSE 50 H. P. BURNER.

fuel (oil) is simply fed by pressure through a spiral pipe to the burner, where (when the generator becomes heated) it is converted into a saturate oil vapor, which, passing out through a weighted valve or orifice, mingles with the air and burns with a clear white flame, giving off an intense heat.

The proportions are such that it is said to burn at a perfect combustion, whether at 1 h.p. or 50. The size of the flame is regulated by changing the supply of oil to the burner. After the burner has been started a short time the igniting point, which extends downward from the combustion chamber, be-

5 H. P. FIRE TAKEN BY ITS OWN LIGHT.

comes red hot and the broken fire brick in the chamber also becomes incandescent, and being inclosed in the iron case will remain so for a long time after the flame has been extinguished (from 15 to 20 minutes). The first escape of gas from the valve passes up through the tube to the combustion chamber, where it is superheated, and explodes the flame to the source of escaping vapor.

These burners, Mr. House states, have been most thoroughly tested and have given the best of satisfaction.

Mr. House has an additional device mounted at d. This is a three-part gravity nozzle, having in each part provision made for an increase of opening for the oil vapor as the pieces are raised from their seats. For example, let the load—or grade of road, which is the same thing—increase, the pressure in the boiler drops slightly and pressure in a increases; this lifts the burner and fire is at once augmented. In practice this arrangement is quite efficient, and as kerosene or crude oil is much less dangerous than the lighter mineral oil spirit, it would seem that burners of the types shown in Figs. 2 and 3 are worthy of further attention by designers of steam propelled vehicles.

The burning of oil by means of an injector is not of very recent date. Oil burning devices, the oil being driven by a jet of steam, or in some cases by compressed air, into the combustion chamber in the form of spray, together with the amount of air necessary for its combustion, have been in vogue for many years. Such a system was patented as early as 1865 and 1867 by Aydon, Wise and Field. Along in 1868 Donald, of Glasgow, patented a similar arrangement.

40 H. P. FIRE TAKEN BY ITS OWN LIGHT.

In a very interesting discussion on the merits of liquid fuel in the Iron Age, the following was suggested for the consideration of users:

"For boiler firing those burners using steam for the blast or jet are more convenient than the compressed air type, and should be more economical, not only because direct steam is cheaper than compressed air, but also that a portion if not all of the contained water in the steam should be dissociated by the high temperature of the flame and the presence of a sufficient quantity of carbon, thus producing a percentage of so-called water gas.

"The burner should be capable of giving a spray of very finely divided oil, thoroughly mixed with the steam. The atomizing action should be purely mechanical, and not due partially to the heat of the steam. It is also a prerequisite that the proper quality and quantity of vapor shall be supplied without requiring a high velocity of blast. As a test of this feature, it should be possible to ignite the spray by using a lighted match only, and this cannot be done if either the velocity is too great or the vapor not thoroughly mixed. There should be but little noise from a properly adjusted burner, and the deafening roar so common in the fire room where oil is used is not only unncessary, but indicates improper action of the burner."

Complete combustion, not only on the score of economy, but as being at once odorless and invisible in the products passing off through stack, is not to be obtained without considerable experiment in burner design, but must be achieved if the use of the heavier oils and steam generators are jointly to become common in street motors. Despite the progress already made, there is yet room for improvement not only in burners, but in their application, in the special form of furnace both to disseminate the heat equally among the tubes and also to combine the air currents properly with the incoming spray, etc.

THE CLARKSON-CAPEL BURNER.

In liquid fuel burners of the vaporizing type there is usually a chamber in which the petroleum is vaporized separately, and which is heated directly by the burner, into which passes the vapor generated in the former. The burner acts on the Bunsen principle, and when the pressure and velocity of the vapor gas are low there is a tendency to "light back," or ignition of the inflammable mixture inside the burner chamber is liable

FIG. 4. END VIEW OF ORIFICE.

FIG. 5. VAPOR DELIVERY NOZZLE.

to take place. Clarkson and Capel, the well-known English engineers, have sought to remedy this defect by providing means whereby the pressure in the burner box may be maintained substantially constant, although slight variations may not be material; this is effected by varying the size or number of the orifice or orifices through which the mixture escapes to be burnt.

Many different ways of effecting this object will readily present themselves. Two of these are to shut off a certain number of the orifices so that a smaller number only remain, or to reduce the size of some or all of the orifices.

In the accompanying drawings Fig. 1 is a plan of a form of burner constructed according to this system, and Fig. 2 is a section on the line 2—2 of Fig. 1; Fig. 3 is a detached view of the burner box, and Fig. 4 is a view of the induction tube air regulator, while Fig. 5 is an enlarged end view of the vapor delivery nozzle.

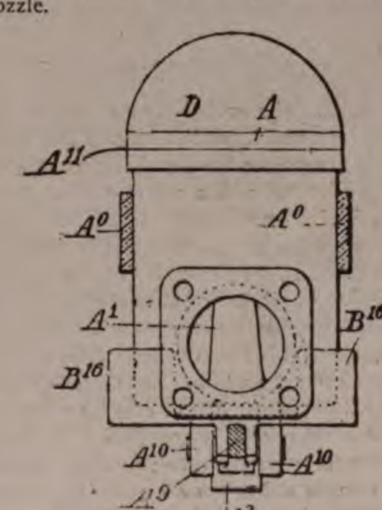


FIG. 3. BURNER BOX.

The burner box comprises a cylindrical body, A, having a casing, A^0, of refractory material and an internal central boss, A^1, bored to form a bearing for a rod, A^2, and having a cover, A^3, with a threaded central boss into which is screwed one end of the rod A^2, on to which it is locked in any desired

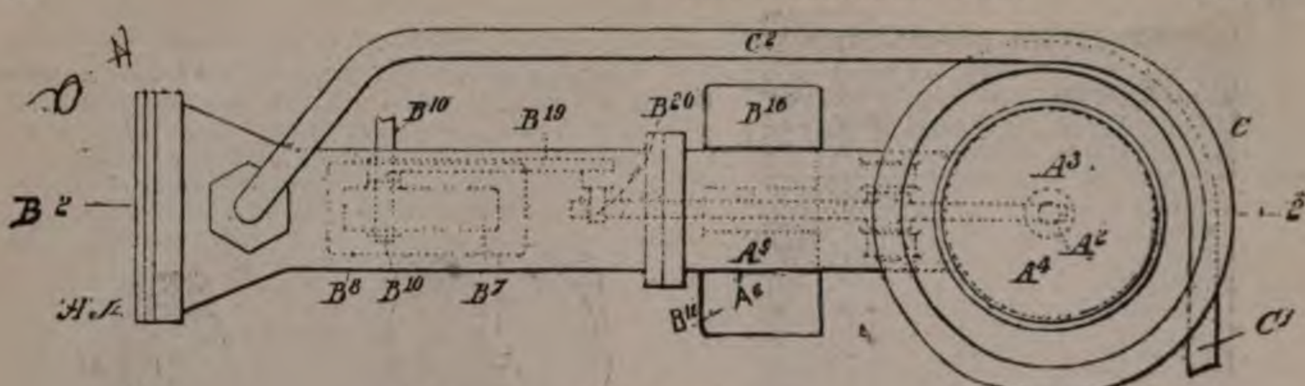


FIG. 1.—Plan.

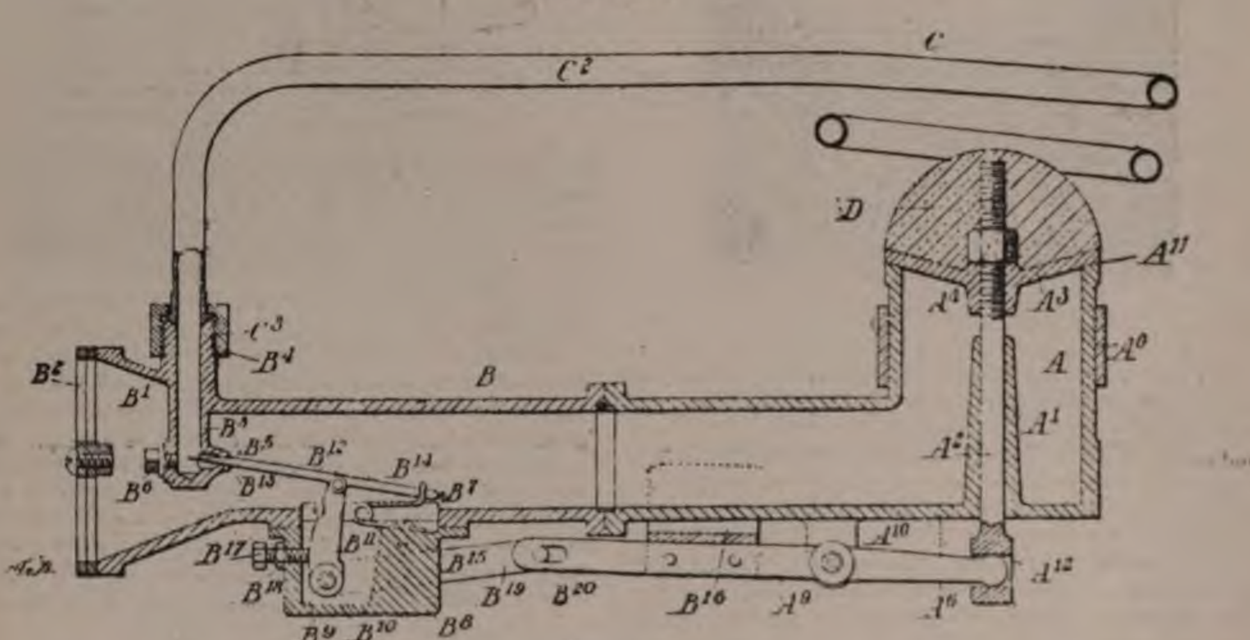


FIG. 2.—ELEVATION OF BURNER.

position by a nut, A^4. The cover fits on the top of the body A so as to completely close it, and is formed as shown in Fig. 2, sloping toward the center boss, and in this case the wall of the body A will be formed with a corresponding top bevel. A horizontal tube, A^8, is formed on the side of the body A at its lower part, connected by flanges with and forming part of the induction tube B. The free end, B^1 of the induction tube B, for the admission of air, is bell-shaped or conical, and provided with a regulating device, a convenient form, B^2, being shown in Figs. 1 and 4. The vapor is delivered through a nozzle, B^3, placed centrally within the tube at the commencement of its normal diameter. It is formed, as shown, integral with the induction tube, and is provided with an externally threaded end for connection with the vapor delivery pipe of the generator. The vapor delivery orifice B^5 is either square or rectangular, a screw plug, B^6, being provided for constructive and cleaning purposes. In the lower part of the tube is an oblong opening, B^7, over which is secured a cap, B^8, having a recess, B^9, through which runs a rocking shaft, B^{10}.

Rigidly secured on the rocking shaft and extending up into the induction tube is an arm, B^{11}, the upper end of which is pivotally secured to a bar, B^{12}, with a chisel-shaped end, B^{13}, which forms the regulator of the vapor nozzle orifice B^5. The beveled face of the chisel is on the upper side, and to hold the flat face against the bottom surface of the orifice tension in an upward direction is applied to the under side of the other end of the bar by means of a spring, B^{14}, secured to the cap B^8 by a screw, B^{15}. A screw pin, B^{17}, with a lock nut, B^{18}, is used to limit the extreme inward throw of the bar B^{12}. One end of an arm, B^{19}, is secured on the rocking shaft B^{10} outside the cap, its other end being provided with a pin, B^{20}. A lever, A^9, fulcrumed in lugs, A^{10}, on the lower side of A^8, is at one end slotted and engaged by the pin B^{20}, its other end engaging in a slot, A^{12}, formed in the lower end of the rod A^3, previously referred to. B^{16} is a counterweight to aid in balancing the lever A^9 and the parts supported by it.

As shown in Fig. 1, the delivery nozzle orifice B^5 is completely closed by the regulating bar B^{12}, and the burner box A is also entirely closed by its cover, A^5. By rocking the shaft B^{10} to give movement of the arm B^{11} to the right, the orifice B^5 can be opened to any desired degree. At the same time, by the action of the arm B^{19} on the lever A^9, the rod A^3 raises the cover A^5, forming the escape orifice A^{11} for the mixture, to a size varying in constant proportion to the size of the orifice B^5 of the delivery nozzle. The rocking shaft B^{10} can be turned by hand or operated by controlling mechanism.

Boiler Requirements.

The late G. H. Babcock, of the Babcock & Wilcox Co., formulated the following conditions requisite if the best results were to be obtained from a steam generator. It is somewhat difficult to combine all the conditions in a boiler, yet as indicative of the path of safe practice in steam engineering the list is well worth repetition:

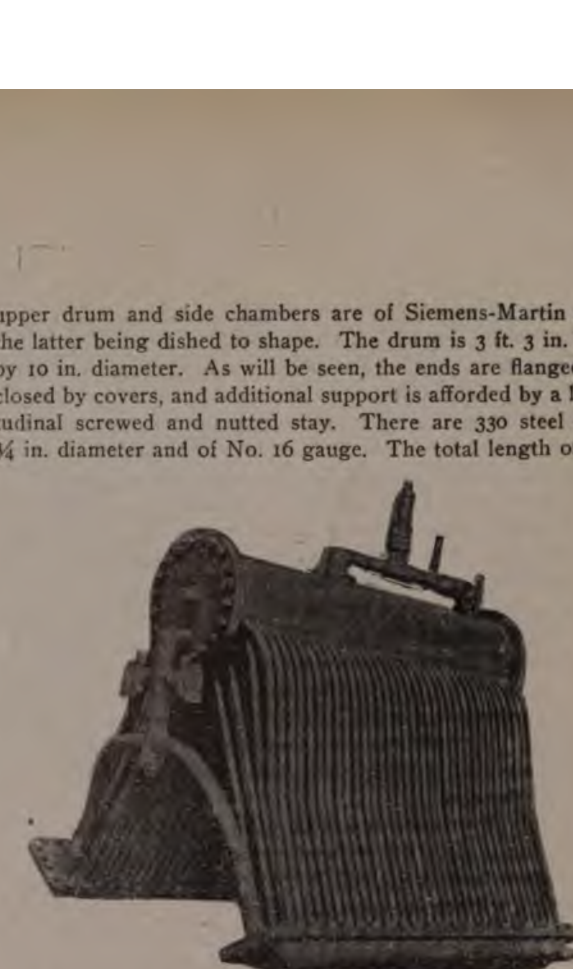
1. The best materials sanctioned by use, simple in construction, perfect in workmanship, durable in use, and not liable to require early repairs.
2. A mud drum to receive all impurities deposited from the water, in a place removed from the action of the fire.
3. A steam and water capacity sufficient to prevent any fluctuation in pressure or water level.
4. A large water surface for the disengagement of the steam from the water in order to prevent foaming.
5. A constant and thorough circulation of water throughout the boiler, so as to maintain all parts at one temperature.
6. The water space divided into sections, so arranged that should any section give out no general explosion can occur, and the destructive effects will be confined to the simple escape of the contents; with large and free passages between the different sections to equalize the water line and pressure in all.
7. A great excess of strength over any legitimate strain; so constructed as not to be liable to be strained by unequal expansion, and, if possible, no joints exposed to the direct action of the fire.
8. A combustion chamber, so arranged that the combustion of gases commenced in the furnace may be completed before the escape to the chimney.
9. The heating surface as nearly as possible at right angles to the currents of heated gases, and so as to break up the currents and extract the entire available heat therefrom.
10. All parts readily accessible for cleaning and repairs. This is a point of the greatest importance as regards safety and economy.
11. Proportioned for the work to be done, and capable of working to its full rated capacity with the highest economy.
12. The very best gauges, safety valves and other fixtures.

STEAM BOILERS, ENGINES AND VEHICLES.

Sargeant's Water Tube Boiler.

W. S. Sargeant, of Chiswick, England, is the designer of a water tube boiler, which is now being exploited in England for motor vehicles.

It consists of an upper drum and two side chambers connected together by tubes resembling in external appearance a Yarrow water tube boiler. There are, however, some differentiating features. Within the upper drum is a sort of basin which serves as a separator and prevents water from passing into the main steam pipe. As the water within the tubes is heated, steam is formed and in rising carries with it globules of water into the upper drum. The steam and water, however, impinge upon the outer surface of the basin and the water falls, the steam rising and collecting in the steam space. The lower part of the upper drum is connected with the side chambers by a bifurcated downcomer, which, being apart from the source of heat, acts as a means of circulating the water. The upper drum and side chambers are of Siemens-Martin steel, the latter being dished to shape. The drum is 3 ft. 3 in. long, by 10 in. diameter. As will be seen, the ends are flanged and closed by covers, and additional support is afforded by a longitudinal screwed and nutted stay. There are 330 steel tubes ¾ in. diameter and of No. 16 gauge. The total length of tub-



ing is over 800 ft. The total heating surface is 135 sq. ft. The normal working pressure is 250 lbs. per square inch, and steam of 100 lbs. can be raised in 10 minutes. Such a boiler can be fitted with a fire grate if required to burn solid fuel, but Mr. Sargeant recognizes the advantages of liquid fuel. The Sargeant patent burner acts on the regenerative principle and is automatic in its action, while from its construction it does not readily get choked by the deposition of carbon; should this occur the deposit can easily be removed, even while the burner is hot. The oil is supplied to the burner from the tank by an air pressure of 7-10 lb. per square inch, obtained by working a small air pump. The consumption of kerosene is 8 pts. an hour.

The following are the weights:

Weight of boiler, burners and mountings, empty.....	907 lbs.
Weight of Contained water........................	110 lbs.
Total	1,017 lbs.

Several boilers of this type have been successfully applied to motor vehicles in England.

There is a close resemblance between the several water tube boilers of Thornycroft, Yarrow and other builders of compact, high power steam plants for torpedo boats and similar purposes.

Take the Sargeant boiler, substitute circular drums for the mud drums shown at lower part of boiler in Fig. 1, place the grate a few inches below these drums and add small mud drums below the grate and connected to Sargeant's lower drums, and you have the latest type of Herreshoff boiler.

A Coil Boiler for Automobiles.

By W. H. Wakeman.

The demand for a light, strong and durable boiler for motor vehicles reminds me of a coil boiler that was made in New Haven in 1884, but which proved to be so far in advance of the

times that its manufacture was not a financial success. The present demand for such a boiler makes it possible to renew the efforts to put it upon the market with much better success.

For small sizes it consisted of ¾-in. extra heavy wrought iron pipe made into one continuous coil by means of ells where a square form was wanted, or coiled the same as for a feed water heater where a circular form was desirable.

The upper end of this coil was connected into a separator consisting of a piece of pipe 3 in. in diameter, placed in a vertical position, upon which was screwed a stout cap. The ¾-in. pipe extended down through and below this cap for several inches, and steam for the engine was taken out through a pipe connected into this cap in the usual way.

The bottom of this separator formed a place for sediment to collect, from which it could be removed at pleasure, for the lower connection was made into the side, several inches above the bottom cap, and this pipe was connected to the suction side of a circulating pump that discharged its water into the bottom of the coil.

From this description it will be plain that the circulation is positive, for it does not depend upon the effects of heat to accomplish it, and as the coil is located directly over the fire, the heating surface is very effective, and as the steam and water are discharged down on to the surface of the water in the separator with much force, due to the action of the circulating pump, and the expansion of a portion of the water as it is turned into steam as each circuit of the pipe is made, this water does not go to the engine, for steam is taken out above it.

The feed water pump discharges into the separator, below the water line, but not low enough to affect the settling chamber already referred to.

This forms a light boiler whose heating surface is exceedingly effective, strong enough to carry 300 lbs. pressure, and it is almost impossible to explode it.

Parties engaged in making it were located in the immediate vicinity of my engine room at that time, so that I had a good chance to watch their operations; but Prof. T. W. Mather, who is now principal of the Boardman Manual Training High School in this city, conducted some experiments with it, and informs me that on one occasion the circulating pump was stopped and the fire continued until the coil was red hot, when the pump was started full speed. The steam gauge pointer at once proceeded to travel over the dial until it struck the other side of the pin, and as this showed more pressure than the gauge was intended for, the actual pressure on the boiler could not be told; but it was very high. The pop safety valves operated promptly, discharging superheated steam that was invisible, but no rupture took place.

The effect of this experiment differed from the results secured with tubular and cylinder boilers, because the amount of water contained was so small for the size of the boiler that the iron held heat enough to evaporate it almost instantly. For the same reason, the speed of the pump must be automatically controlled in order to maintain a proper water level at all times.

When coal is burned for making steam in this boiler, it may be fed in by a hopper the same as for a cylinder stove, and gasoline also makes a very efficient fuel, as the layers of the coil may be "staggered," which will cause them to be entirely enveloped by the flames on their way to the chimney. The whole is inclosed with a sheet iron casing, filled with a suitable lining.

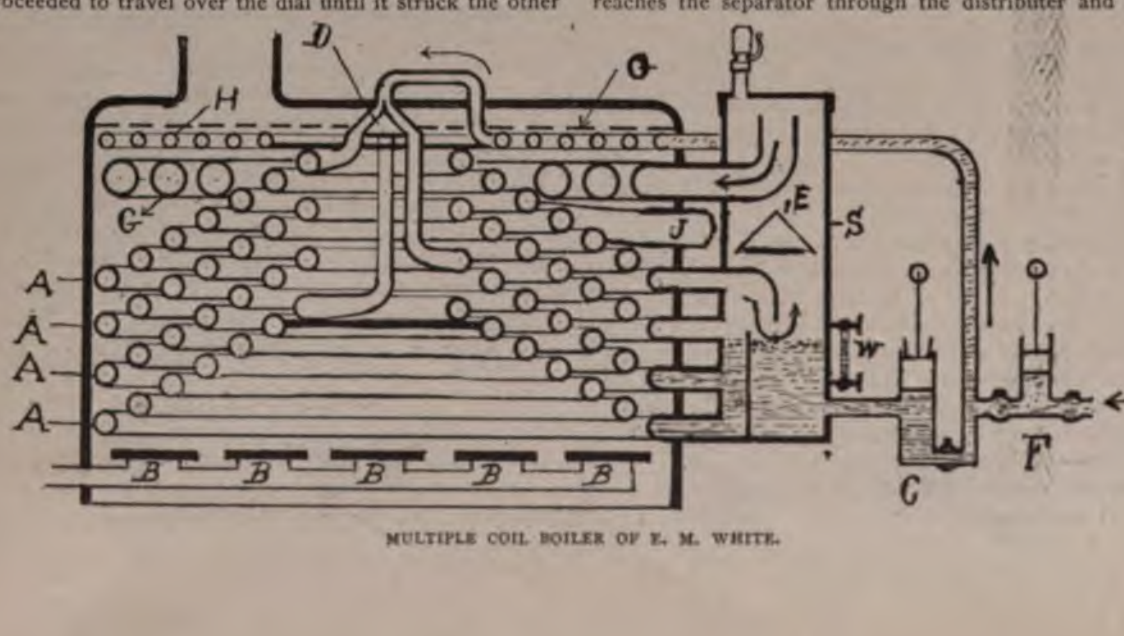
A Multiple Coil Boiler.

By E. M. White.

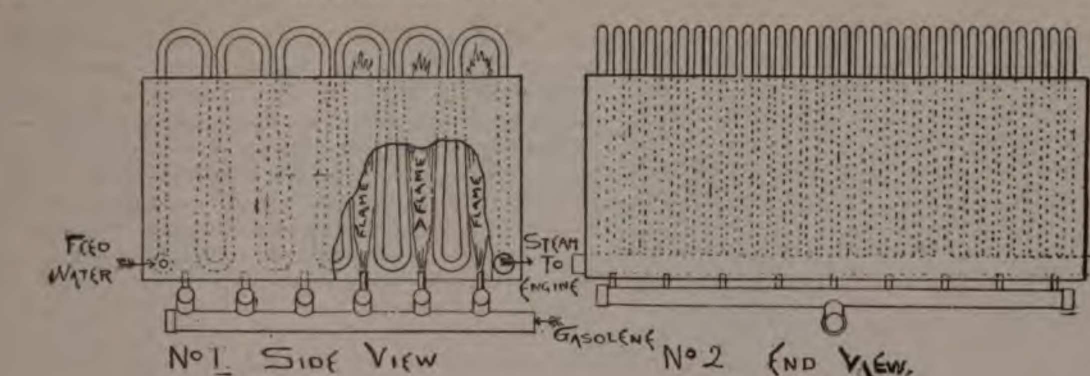
This boiler is constructed upon the same principle as the Herreshoff single coil boiler, a boiler that for its weight gave great power. It required the most skillful firing and would frequently become overheated when the engine and circulating pump were stopped. These features or faults are with liquid fuel and automatic fire regulators overcome.

The boiler shown I have been using in a small steam launch, where it is giving entire satisfaction and is called upon frequently to withstand a working pressure of 200 to 350 lbs. per square inch for hours at a time.

The operation of the boiler is as follows: On starting the engine sufficient water is placed in it to about fill the first or lower coil. After steam is raised the circulating pump C draws water from the separator S, forcing it under a few pounds pressure through the heater coil H to the distributer D, where it is divided and part sent to each of the generating coils A A A A. From the distributer it flows by gravity through the coils to the separator S, where the steam and water are separated. Steam accumulating in any of the coils reaches the separator through the distributer and the upper



MULTIPLE COIL BOILER OF E. M. WHITE.



E. A. SQUIER'S FLASH BOILER.

coil A. From the separator the steam passes through the superheating coil G and to the engine at J.

With this boiler, as with the Herreshoff single coil boiler, it is absolutely necessary to have the circulating pump C and to keep it and the feed pump running while the engine is in motion. For a steam vehicle this seems to me to be an ideal boiler. It is compact, weighs but little for the power developed, contains but little water and steam can be raised in a few moments. It has given entire satisfaction and is not costly to make. On this boiler and many of the details patents are now pending.

A A A A—Generating coils.
B B B B B—Burners.
C—Circulating pump.
D—Distributer.
E—Deflecter.
F—Feed pump.
G—Superheating coil.
H—Heater coil.
J—End of superheater leading to engine.
O—Perforated deflecter or diaphragm.
S—Separator.
W—Water glass.

Edgar A. Squier's Flash Boiler.

The accompanying rough sketch of a vehicle boiler is contributed by Edgar A. Squier, of Overton, Cal.:

The boiler, of the flash generator type, is made of ⅛-in. iron gas pipe, manifolded into ¾-in. pipe, the whole contained in fireproof casing (see diagram and drawings).

The inventor proposes to use a small fixed amount of water, supplied by a cross head pump, and heat it to the required degree to do the work, whatever that may be. The throttling is to be done at the gasoline supply valve. A float in the water tank will shut the water off when it becomes too low from use.

The heat is applied to the coils by numerous gas jets, one or more of which is left burning to ignite the others in starting up. A compound engine of two cylinders with large bore in proportion to the other parts could be used, working at not over 50 or 60 lbs. pressure. The economy could be obtained by the super heat gained in the length of heating coils used, and also by the expansion in the extra large cylinders.

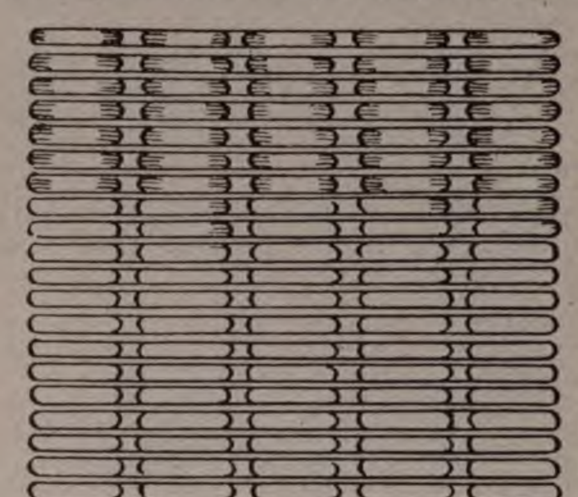


FIG. 4.—LOOKING DOWN ON TOP OF COILS.

For a cheap, efficient, light boiler the inventor thinks this would be hard to beat. The scale could be prevented by using some solvent in the feed water. At Overton, where Mr. Squier resides, quite a number of small locomotives are used, and as a solvent a little brown sugar is put into the feed water once or twice a week.

FIG. 3.

The Thomson Flash Boiler and Steam Vehicle System.

By L. H.

In reply to your invitation to discuss the most suitable boiler for horseless carriage work, I beg to submit the following:

Three years ago, when Prof. Elihu Thomson first directed his attention to the practical working out of a long-cherished plan to construct a self propelled vehicle, the various possible motive agents, such as compressed and liquid air, gasoline and kerosene motors of the internal combustion type, electric motors and steam engines, were carefully gone over and steam was chosen as the one which at the time was more likely to fulfill all the conditions, provided it could be made entirely safe.

That there exists an element of danger in a boiler, which upon its rupture may suddenly liberate a large amount of stored energy, nobody will deny, and the rigid control which is enforced by the United States steamboat inspection service and that of all foreign civilized countries alike, over any and all vessels of any size propelled by steam, is proof of the existence of such a danger.

To make a successful steam carriage which may be placed in the hands of operators not necessarily trained required the setting of a higher standard than the mere carrying out of a conservative practice used with units where skilled attendance is not only necessary, but cuts but a slight figure in the economic part of the running expenses. Even in this undertaking we were not without a precedent, others like Herreshoff and Serpollet having achieved encouraging results, and boilers of a type which in the earlier times were not commercial, are certainly so to-day, owing to the general advancement in engineering lines.

Steam boilers may be roughly divided into three types: 1. Shell boilers, the prototype of which is the tea kettle. 2. Water tube boilers. 3. Flash boilers.

Taking up these in succession:

Shell boilers are mostly in use for medium size and small plants with moderate pressures. This type is the most dangerous in existence, owing to the large quantity of steam and water contained in a form of vessel which can but imperfectly resist abnormal strains which may be brought upon it. They require watching to see that there is water supplied in sufficient amount at all times; that the water is free from mineral salts, oil, etc.; that the fire is proportional to the work and that the pressure does not exceed a certain safe limit. The last two objections have been partially overcome by the use of liquid fuel, which permits the fire to be more readily adjusted and controlled by the steam pressure. The danger from having too much pressure or insufficient water is always present and cannot be avoided with certainty by the conventional safeguards, such as safety valves, fire checks and water gauges.

The advantages of the shell type are that owing to their great storage capacity there is considerable latitude in the controlling forces, giving the operator time to watch them. There is also spare power available for extra demands.

Water tube boilers are used almost exclusively in large power plants and in the navy. They permit high pressures to be carried with reasonable safety. The steam drums which carry the stored steam are not subject to the great variations in temperature and the corroding influences of impure water, nor are they in direct contact with the fire. The part which is subjected to these adverse influences in modern boilers is made of seamless tubes of the best quality and they are far more capable of withstanding abnormal strains than the shell type. They are open, however, to the same objections in regard to water feed and excess of pressure as the shell boiler, but in a less degree. Boilers of this class are fairly economical, especially when used in connection with several expansion engines, and may be used to advantage in such conveyances as, owing to their size and constant use, require special attendants, viz., passenger busses, heavy trucks, fire apparatus, etc.

Flash boilers, which are but little understood and often too quickly condemned, have the great advantage of simplicity and absolute safety, which features make them the ideal boiler for self propelled vehicles. First brought out in this country by Herreshoff, they were used on a number of yachts, but have generally failed through lack of control of the fire and because of a system of return piping which did not permit of forcing the water through overheated tubes. Ordinary screwed joints were also apt to cause leaking when alternately cooled and heated. By the use of seamless steel tubing of small bore and thick walls, and the Thomson electric welding process, it is possible by moderate labor to make such a boiler that will weigh but 75 lbs. in its generating parts and give a steady output of 4 h.p. in a suitable engine. It can withstand pressures up to 6,000 lbs. and requires neither steam gauge nor water glass. Normally the fire is banked with no water in the boiler. To start action water is forced into the coil, which, upon the formation of steam and its use in the engine, automatically maintains the water feed and keeps the fire proportionate to the work. If anything goes wrong one may get stalled as with any other machinery, but without thereby incurring the slighest danger. Again, the steam produced is superheated and of a high pressure, which conduces to an invisible exhaust. Under normal conditions, even on frosty days, but little condensed steam is visible.

To use superheated steam effectively a special engine had to be designed, in which Prof. Thomson showed his usual independence of the beaten path. The fact that about the same time Mr. Léon Serpollet, in France, produced independently a similar engine and method of control does not in any way detract from his credit. This type of plant is, in the writer's opinion, destined to make the steam carriage as safe a conveyance as the electric carriage, being, however, without the excessive weight and its limitation to conditions of local supply or recharging.

It would be unfair to the reader to state that there are no drawbacks in a boiler of the flash type. The shorter life of the superheating part of the boiler and the closer methods of control required to feed the boiler with water and the burner with fuel are the chief disadvantages. It stands to reason that in the flash method of generating steam without storage, which might be likened in finance to the immediate spending of one's earnings, the steam generation and heat production must be made to follow each other closely. While involving a greater research and experience as to the proper construction of the controlling elements, these are well within the commercial production and understanding of men of average intelligence. They may be summed up as follows:

Into one end of the boiler coil, water is forced in a definite controllable quantity and at the same time the burner is fed in a definite ratio thereto. From the other end of the coil the steam is fed to the engine, which, being provided with cam-actuated poppet valves and an exhaust uncovered by the piston itself, can work at its best with a consumption so remarkably small as 20 lbs. of water per horse-power hour, and

this in an engine of not more than 1 h.p. normal, without compounding or condensing. An engine with four cylinders gives 4 h.p. A regulating lever allows the combined quantity of oil and water to be varied at will and thereby controls speed and torque without any change of gears. The boiler, if too highly heated, may wear out, but it is so cheap to build and so easily replaced, that when one considers the absolute safety obtained by its use this item need not be considered as important.

While it is admitted that in starting out in a radically new line many difficulties have to be overcome which do not exist in other well-known types, it is gratifying to see that once they are overcome, a carriage is produced which uses ordinary kerosene (not gasoline) as a fuel, burning the same automatically with practically no odor, and which can climb any grades to 20 per cent. without any change of gears. Such a carriage shows very little steam, is not affected greatly by the quality of the water used and has a boiler which under all conditions is absolutely safe against danger from explosion. This safety is not obtained by surrounding it with controlling safeguards, but follows from its construction. It can be destroyed by violence, but cannot at the same time injure any one.

The House Compound Vehicle Engine and Water Tube Boiler.

Henry A. House, of Bridgeport, Conn., inventor of the system in use by the Liquid Fuel Engineering Co., of Cowes, I. W., England, has designed an engine for heavy vehicles weighing 175 lbs., with pumps attached and running up to 2,000 revolutions a minute. It is of the compound steeple type with hollow piston valves operated by link motion and three-throw crank, the case being closed.

ENGINE AND BOILER.

The cylinders, 1½-in. high pressure, 3¼-in. low pressure and 3½-in. stroke. The floor space is 8 x 24 in. and the height 26 in.

HOUSE WATER TUBE BOILER.

The photograph shows one of Mr. House's patent non-corrosive water tube vehicle boilers for liquid fuel (15 h.p.), with

THE HOUSE VEHICLE ENGINES.

one-half of the case removed to show the grouping of the tubes, which are so arranged that a steam blow pipe can be passed along between them, cleaning them in a few minutes without removal of the case.

GROUPING OF BOILER TUBES.

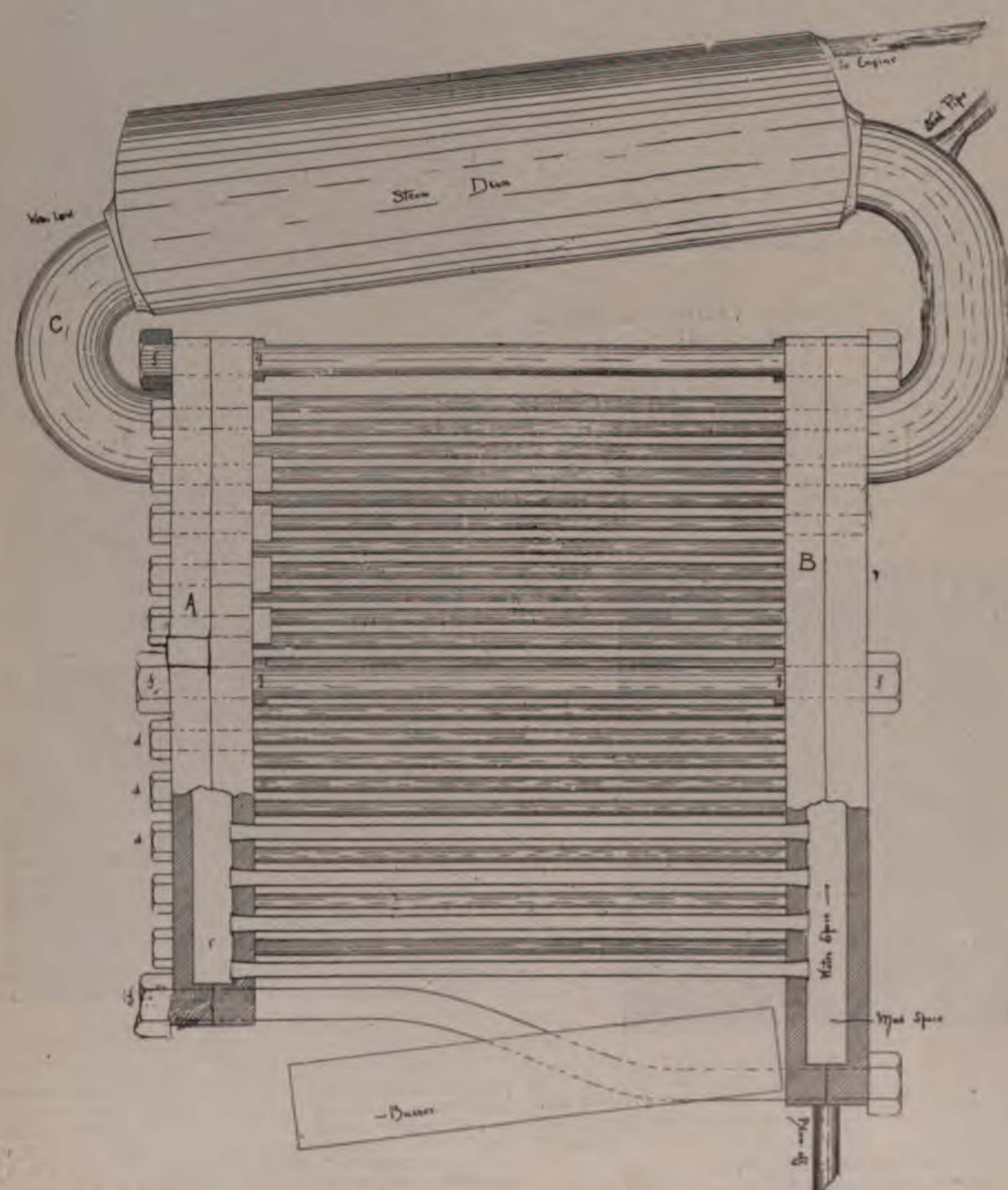
This boiler has 65 sq. ft. of heating surface and 208 ½-in. seamless drawn copper tubes secured by patent fastenings. Its weight is about 550 lbs. with contents and including fire and water regulators. Its floor space is 18 x 24 in. and its height 26 in. It has a thermostatic regulator, rendering it impossible to burn the boiler from lack of water, and also a fusible safety plug, which is claimed to make it "fool proof." It is designed to carry 250 lbs. pressure and is tested according to Government rules for marine boilers.

Design for an 8 H. P. Water Tube Vehicle Boiler.

By Harry K. Burr.

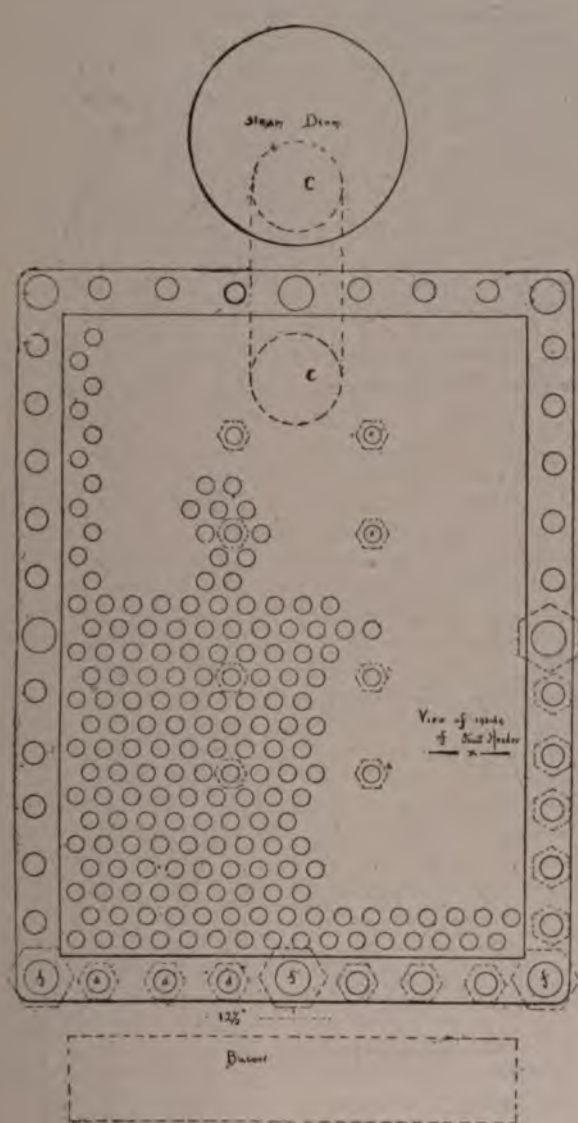
Following is a description of a steam boiler recently designed by the writer for an automobile, and shortly to be put under construction. The two principle points kept in view were absolute safety and great durability, and, secondarily, ease of inspection and repair. Absolute safety can be secured only by the adoption of some form of water tube construction, and the writer thoroughly believes that this form of construction will ultimately be adopted for use on all steam vehicles.

Shell boilers are safe as long as the water is not allowed to become low. This, however, is a contingency which is bound to happen occasionally as long as the boilers are necessarily under the management of people inexperienced in the use of steam appliances, and when it does happen there is great danger. Vertical boilers are peculiarly liable to serious accidents



8 H. P. VEHICLE BOILER OF H. K. BURR.

in the case of low water, for if the tube sheet becomes overheated it usually lets go from all the tubes at once, suddenly releasing the heated water and steam in a downward direction. This projects the whole apparatus upward, skyrocket fashion, and with tremendous force. It can be shown that the energy contained in 4 gals. of water under the temperature and pressure of steam at 200 lbs. per square inch is capable of causing as much destruction as the explosion of nearly if not quite 40 lbs. of gunpowder. An explosion of this kind would probably cause a feeling of pain and surprise to those sitting directly over the boiler. It would also probably cause death.



The following design of water tube boiler is very similar in general principle to those in use for larger powers, though with important modifications. It is calculated for a working pressure of 200 lbs. per square inch, and a large factor of safety has been used in figuring the various parts:

DATA.

Heating surface	46.5 sq. ft.
Capacity in water	4.4 gals.
Weight of boiler	150 lbs.
Size of copper tubes	⅜ in. x No. 24 gauge
Length of tubes exposed	13 in.
Number of tubes	408
Width of boiler	12½ in.
Height of boiler	27 in.
Depth of boiler	18 in.
Weight of copper tubes	40 lbs.

As will be seen from the drawings the boiler is constructed of a nest of ⅜-in. copper tubes expanded into two cast steel headers, A and D, and the headers connected to a steam and water drum above. The drum is placed horizontally and the tubes and headers are inclined at an angle with it. The heated water rising flows upward through the tubes into the water spaces, and continuing upward reaches the water drum through the 2-in. connection c. Here the steam and water are separated and the water, continuing, leaves the drum at the other end and flows downward through the water space to the lower ends of the tubes, where it again begins its journey. It will be seen that a rapid and continuous circulation is maintained in each one of the tubes, allowing no time for the formation of scale. In no part of the boiler is the water at rest for a moment except in the small space in the lower end of the rear header. Here is provided a mud space, where all sediment may collect and be blown off. The headers are each cast in two similar pieces from steel, one-half being drilled with slightly tapering holes and the tubes expanded into them with a burnishing tool in a drill press. The outer edges are planed and finished to make a steam tight joint, and are bolted together with ½-in. bolts, d d d. The two halves of each header are staved with eight ¾-in. studs screwed into eight of the holes as drilled for the tubes, and passing through the outside face of header are secured by nuts, e e e. Although the tubes as expanded into their holes would be capable of holding the headers together, yet they are not allowed to do this, but instead the strain is taken by eight ¾-in. bolts passing through each header, as shown at f f f, and having nuts or shoulders which bear against inner face of header at g g g.

Steam pipes to engine, boiler feed and blow off enter as shown. The connection between water space and steam drum could be made of 1½-in. steam fittings, though shown as a solid continuation of the drum reduced in diameter to 2 in. The sheet iron casing and lagging around boiler are not shown. This boiler is calculated to develop 8 to 10 h.p. and is suitable for a carriage weighing 800 to 1,200 lbs. and carrying four persons with luggage, as for touring. For a lighter two-seated carriage the size of boiler might be considerably reduced, allowing not more than 30 sq. ft. of heating surface. Heating surface composed of horizontal tubes, as in this construction, is far more effective than the same amount of surface vertically disposed. This boiler can be readily taken apart for inspection and repair, and on account of the rapid and complete circulation it is impossible for scale to form, thus avoiding deterioration and loss of power. And last of all, it is safe. For should all the water be boiled out the only damage that would occur would be the splitting of a few of the tubes and the gradual reduction of the pressure.

The Locomobile.

By R. I. Clegg.

The Locomobile, Stanhope pattern, has a single seat to carry two passengers; weight about 450 lbs.; 28-in. bicycle pattern wheels, and 2-in. pneumatic tires; wheel base about 56 in. and the gauge 50 in. These dimensions may have been slightly changed at different periods of manufacture and should be considered as approximate to the average product of the factory.

The frame is neatly built up on cycle lines, using 1¼-in. steel tubing. The original frame on the first Stanley carriage seen by the writer, was entirely of straight line construction, stiffened or reinforced by suitable wooden cores at various points. Following out the idea of American pin girder construction, the old frame was jointed with turned studs brazed into the tubes and passing through holes in the corner pieces. The present frame avoids this expensive arrangement by giving a curve to the tubes which pass over and lengthwise of the axles. The ends of the curved member are brazed into a fitting which also retains the axle tubes.

The frame supports the steering apparatus, which is of the simplest type; the steering lever acts upon a crank, which in turn is connected by two small rods to the pivots of the forward wheels. The pivots have the familiar offset cranks to increase the turning effect upon the inner wheel when rounding a curve.

In Fig. 1 is shown a plan of the general arrangement of the mechanism and tanks.

Here M M are the gauges, the one indicating the steam pressure in the boiler C, usually 130 or less, and by means of a regulator kept below 150 lbs. to the square inch; the other shows the air pressure in the gasoline tank T. The pressure in T is obtained by means of a small hand pump temporarily connected to a nipple near M, this procedure being similar to the process of inflating pneumatic tires. This air pressure is used to drive the gasoline through the burners to the boiler base.

The oil reservoir T is placed under the feet of the passengers and is filled through a screw-capped opening. To the right of the passengers and convenient to the hand of the driver are placed three handles, a, f and o, working on a common axis. The first, a, regulates the admission of steam to the cylinders and consequently governs the speed of the vehicle. The handle acts by means of a lever on the throttle valve A by means of a hollow rod, K.

The second handle, f, is connected to F by another hollow rod passing through K; this works directly upon the sector of the link motion and is equally useful for a temporary stop or change of speed as well as reversing the carriage.

The third lever, o, regulates the feed water through a by-pass valve, O. This valve can be adjusted to return a portion or all of the supply back to the tanks.

The boiler C is placed in the middle of the body and is surrounded by the water tanks H H in horseshoe form. This arrangement has the advantage of heating the water to some

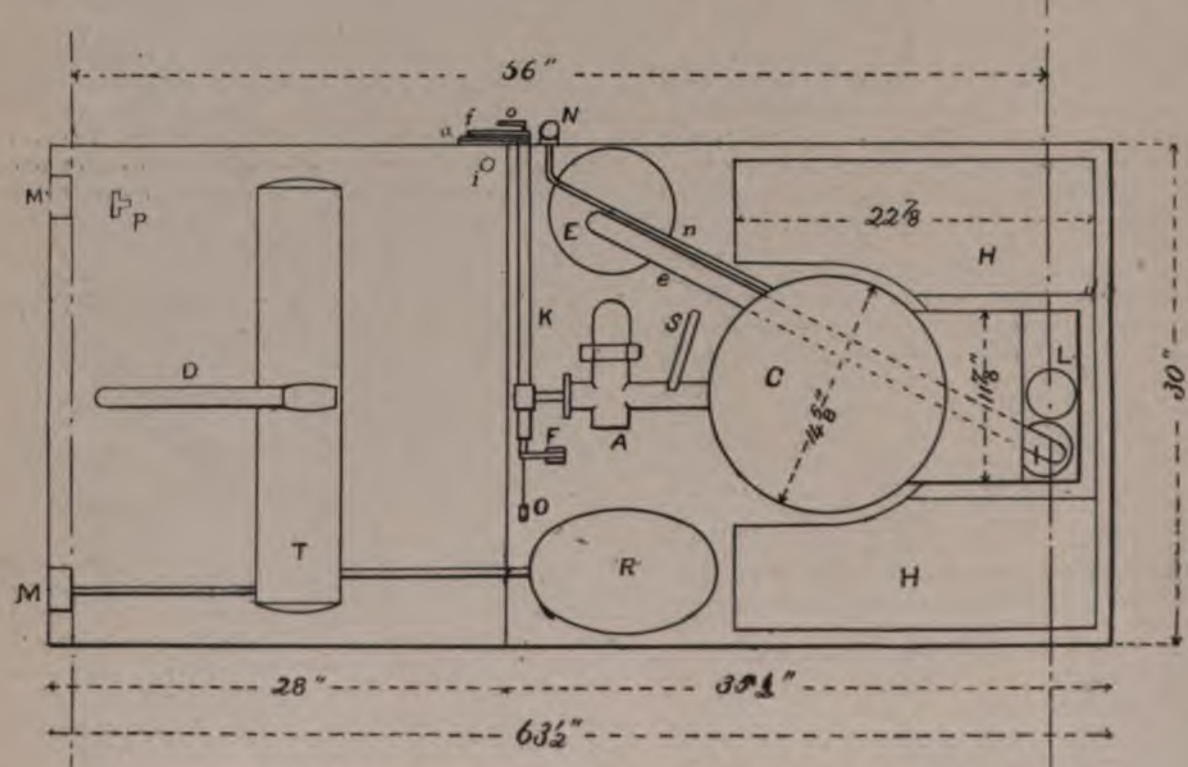


FIG 1

extent prior to its introduction in the boiler. The water is poured into the tanks through a small square opening directly behind the seat.

The exhaust steam, after leaving the cylinder, passes into the chamber E, which acts as a muffler to some extent, and from thence through a tube, e, to an opening, I, through the water reservoir, and thence to the rear of the vehicle.

The tube S leads to the safety valve, set at 170 lbs. to the square inch.

The differential gear is placed on the center of rear axle; it carries the band brake pulley, which is operated by a foot lever, p.

Steam is generated in an upright tubular boiler, C. This is composed of a sheet steel cylinder with heads of the same material. This is, we understand, the material now used, though in the earliest carriage copper was the choice for this purpose. Around the boiler shell are wound two layers of steel wire, about No. 18, Brown & Sharpe gauge. This increases the strength of the boiler immensely. There are 300 copper tubes about ½ in. diameter and No. 20, B. & S., thick. These tubes are expanded in the tube sheets and form passages for the heated gases arising from the combustion of oil in the burner situated directly underneath.

The boiler is piped to a water glass, N, on the outside of the carriage body; a small mirror placed on the dashboard below the gage M permits inspection of the water level. Boiler has about 45 sq. ft. of heating surface.

To the writer the Stanley burner is the most notable feature of the Locomobile, and an attempt at a thorough explanation of its peculiar construction will now be given. Three views of the burner are shown in Fig. 2, the upper one being the plan and the others a vertical elevation and section respectively. The burner body is made of a flat cylinder of the same diameter as the boiler and attached thereto by angle fittings, A A. The oil fuel passes from the supply tank T through the boiler, where it is heated to a gaseous condition, and enters the burner in a state of vapor. The body of the burner holds a smaller concentric cylinder of sheet steel, which receives the vaporized oil from the boiler.

This latter receptacle is traversed by 114 vertical copper tubes, E E E. These form air passages, and the scheme, it may be here stated, is analogous to a Bunsen gas burner in multiple form. Around each of the air passages E the steel upper sheet is perforated with 20 holes about 1-32 in. diameter. The vaporized oil escapes through these small holes, ignites and in long flames sweeps up into the 300 tubes, where it is thoroughly consumed with an intense heat.

A tube, T, receives the oil vapor coming from the reservoir to the burner.

In the side of the burner is cut an opening, b, to receive an auxiliary heating tube when the boiler is cold and it is necessary to volatilize the oil by additional means to those employed when the vehicle is in motion. This heating tube is in the form of a return bend or U. This is heated and connected by a branch from the oil regulator. The opening c receives the tube conveying gasoline to burner from boiler.

The oil regulator is a simple contrivance for varying the amount of vaporized gasoline supplied to the burner in order to maintain a constant pressure in the boiler irrespective of load or speed of vehicle. The regulator consists of a metal diaphragm held between the rims of two circular chambered castings by a steam tight joint; one side of the diaphragm is piped direct to boiler and pressure acts directly thereon; on

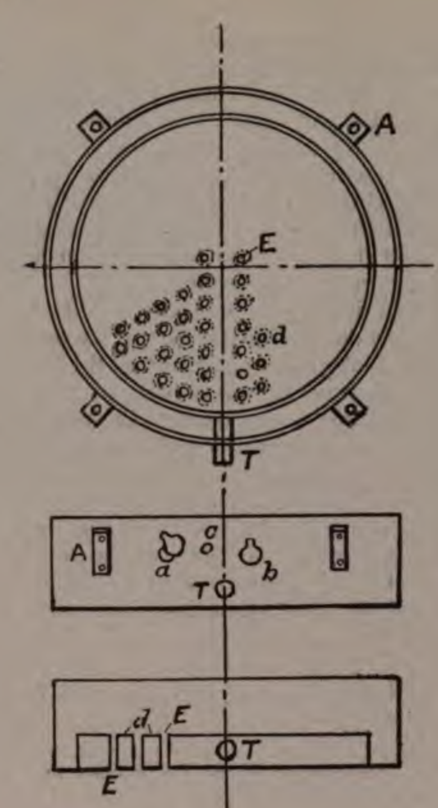


FIG. 2

the other side of diaphragm is attached the rod leading to valve regulating oil supply. Thus when the boiler pressure reaches a predetermined point the diaphragm moves outward and by means of the rod cuts off the oil supply to burner, and as pressure drops the reverse action takes place, maintaining a constant pressure thereby. The regulator is of bronze, with brass piping, and is at once a neat and effective contrivance.

It will be noted that the air passages E E remain open, and when vehicle stops and pressure in boiler raises to the point when regulator cuts off oil the cold air passing up through boiler tubes materially aids in bringing down the temperature and pressure in boiler.

There is a vast difference between burning fluid gasoline and gasoline vapor with air current passing freely. Suppose the covers to peep holes are left open, as the writer has occasionally seen them, and under favorable conditions, as, for example, running on a down grade, the supply of oil to burner is diminished and the enfeebled flame is easily blown out. The gasoline vapor from the boiler is liable to condense and collect about the adjacent surfaces and suddenly burst into flame on the exterior of the casing. The obvious way of avoiding this condition would be a pilot light, which would to a certainty insure the lighting of the vapor as it issues from the inlet tube of burner. Several accidents with gasoline burners under automobile boilers have occurred, not only with the particular machine under consideration, but others, and even at the risk of adding some complication and weight everything that mechanical skill can devise should be applied to the safe and complete combustion of so inflammable a liquid as gasoline.

The engine is a two-cylinder, vertical marine type with ball bearing cranks and shaft. It is attached to front of boiler and is directly under the seat. The engine frame is of the lightest T-angle construction with single shoe guides. From center of crank shaft to top of cylinder covers equals 17 5-16 in., the stroke is 3½ in. and cylinder diameter 2½ in. In center of crank shaft is the chain sprocket of 12 teeth; the Baldwin chain runs over a 24-tooth sprocket on the differential gear on the rear axle. The engine turns at some 300 revolutions per minute and develops nearly 5 h.p. at this speed.

To start: First fill up the water tanks and the boiler to a height indicated on the water glass; see that the reservoir contains sufficient oil under air pressure and all the mechanism is well oiled and then proceed to the burner.

As already indicated, get the heating tube hot in any convenient flame; a forge or plumber's outfit will serve admirably; insert this tube in the opening I of the burner and branch by one of its extremities to a pipe from the regulator. The other extremity comes to the opening in the burner tube. Then open the regulator valve. This allows the oil coming from the reservoir to be vaporized by its passage through the heating tube and the vapor enters the burner by the avenue T. When the temperature of the boiler is sufficiently high to heat the oil tube passing through, the valve leading to the U-tube is closed and the hot tube is removed and for the future the burner is automatically governed by the boiler pressure.

So far as the achievements of the Locomobile in hill climbing and speed contests are concerned, these are well described in the literature distributed by the Locomobile Co. and need not here be repeated; sufficient information is, however, given to permit the reader a fair grasp of the several peculiar constructive details of an exceedingly interesting attempt to solve the problems incidental to the application of steam to highway locomotion.

The Locomobile has been largely imitated in the United States by other builders.

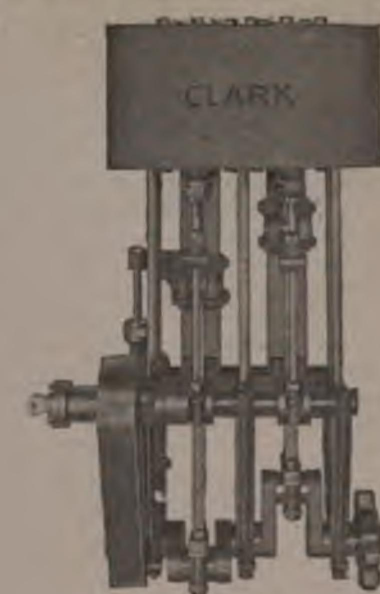
The Clark Steam Vehicles, Boilers and Engines.

Edward S. Clark, a marine engineer of 272 Freeport St., Harrison Square, Boston, Mass., is constructing special engines and boilers for carriages. He manufactures two styles of engines, a double cylinder reversible weighing 50 lbs., and a double cylinder, double acting reversible engine weighing 35 lbs.

The first is reversed by an independent shaft driven from the crank shaft by encased gears, and the second by link motion. The bronze cross head, of the slipper pattern, fits around the slide, which is of steel, and forms the back of the frame. The base is a bronze casting. Crank shafts, connecting rods, pistons, etc., are of forged steel.

The boiler which is at present building is of the vertical steam shell type, with heads of flange steel. Although light they are strong, being tested to a pressure of 800 lbs. The height from bottom of burner to top of hood is 21 in. and the diameter 16 in.

The burner, on which Mr. Clark has applied for patents, is on the Bunsen principle, using diaphragm regulator to maintain a uniform pressure.



CARRIAGE ENGINE, CLASS A.

Mr. Clark's steam dos-a-dos was described in our issue of Oct. 4. A still more interesting vehicle is the delivery wagon he has since completed for J. G. & B. S. Ferguson, bakers, 853 Albany St., Boston, Mass.

Steam Engines in the Hubs.

The Keystone M. & M. Co., of Lebanon, Pa., have just completed a steam automobile on the lines indicated by the engraving below. The motive power is steam, generated by a small tubular upright boiler of the general shell type used in light vehicles. The application of steam is through small


THE KEYSTONE STEAM CARRIAGE.

cylinders in the hub of the wheel, as shown by the cut, each of the rear wheels being supplied with three small engines of that type. This, it is claimed, permits an increase of power, according to the size of the boiler and cylinders used, and also allows the construction of vehicles of a lighter type than when heavy engines are attached to the body or framework of the carriage. The fuel is gasoline generated from a hydrocarbon burner.

The construction of the motors is such that they dispense with the use of sprockets, chains and compensating gears, each wheel being independent of the other on a stationary axle.

At a speed of 200 revolutions of the engine the carriage will travel 20 miles an hour. The company expects to be in position to supply both light vehicles and trucks for delivery purposes at an early day. Their factory is well equipped for work of this nature.

The Stanley Mfg. Co.'s Steam Carriage.

The Stanley Mfg. Co., Lawrence, Mass., and 117 Lincoln St., Boston, Mass., furnish the following very complete data of the steam carriage which they manufacture:

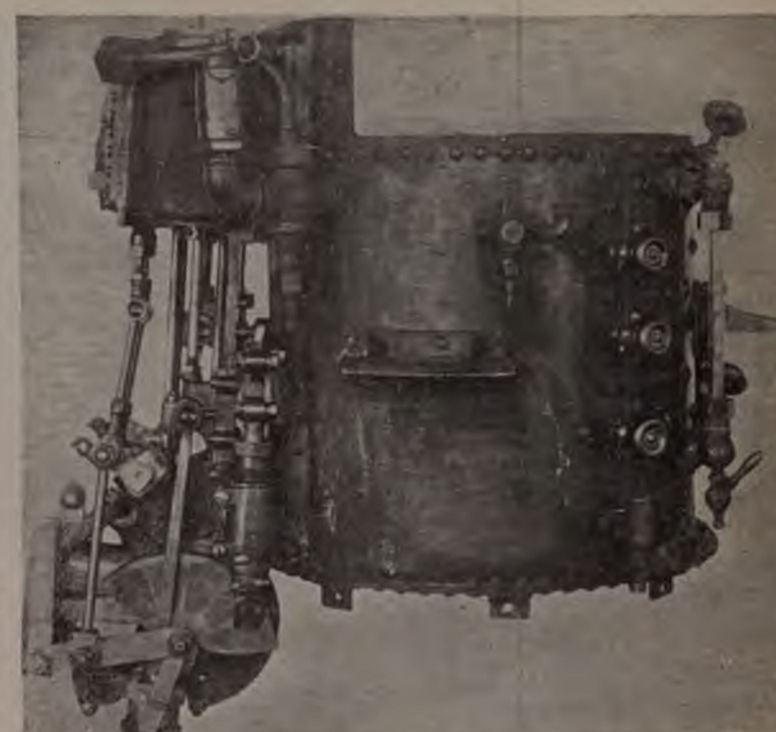
The engine has two cylinders, 2¼ in. diameter and 4-in. stroke, and speeds up to 80 revolutions, corresponding to 25 miles an hour. Its weight with feed pump is about 60 lbs. The cylinders are lined with cast iron bushings and are jacketed with steam at boiler pressure. The cylinder jackets are drained back into the boiler. The cylinder valves are of cast iron, working on bronze seats, and are of the Allen double port type.

The valve motion is the well-known Marshall gear, largely used on marine engines. The engines are reversible and the cut-off can be varied from one-quarter to three-quarter stroke by the motion of the reversing handle. The pistons are made of mild steel, turned from the solid bar, and are each fitted with two cast iron spring rings with steam tight joint piece to prevent steam leaking by the ends of the ring where it is cut. The cross heads are of bronze and have very large wearing surface upon cast iron guide bars. The crank shaft is drop forged from open hearth steel, and runs in bronze boxes lined with hard Babbitt metal. The crank pin end of the connecting rod is of the marine engine type and is fitted with bronze boxes lined with hard Babbitt. The crank shaft is counterbalanced to run without vibration at high speeds.

All engine and valve motion bearings are fitted with siphon oil cups and oil tubes, and all oil dripping from bearings is caught in an oil tight casing, thus giving "splash about" lubrication to crank and shaft bearings. The entire engine and valve gear is inclosed in a dust proof casing.

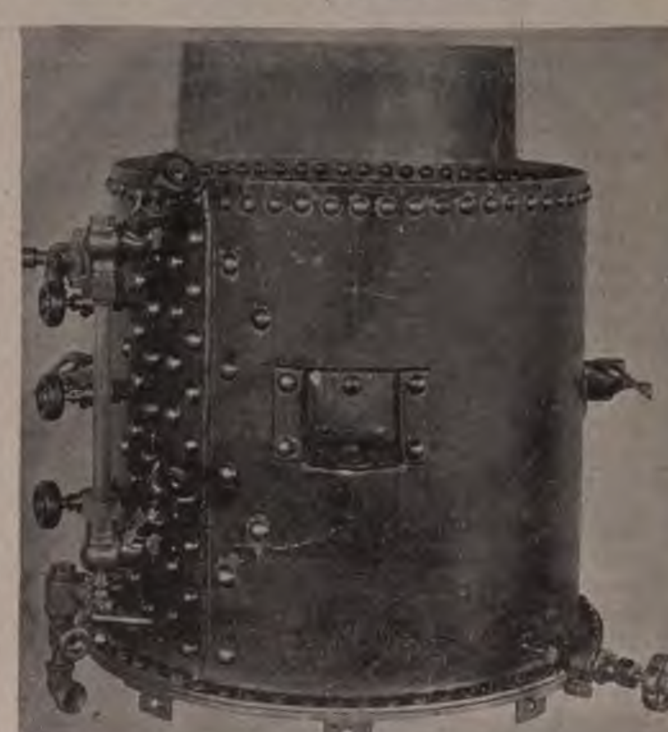
The boiler, 14 in. in diameter, has 295 ½-in. copper tubes 13 in. long. It is made of steel 5-32 in. thick, with riveted joints. The longitudinal joint is a quadruple riveted double butt strap joint. The heating surface, including the copper feed water coil, in the burners, is about 40 sq. ft., and would be rated as about 4 h.p. With fittings it weighs about 110 lbs. and is tested to a pressure of 250 lbs.

The boiler is fitted with an internal dry pipe with small holes to supply dry steam to the engines. The outside of the boiler and smoke bonnet is covered with magnesia plastic composition, as a non-conductor of heat, and with a jacket of polished aluminum. In addition there are a pressure gauge, Crosby pop safety valve, check valve for feed water

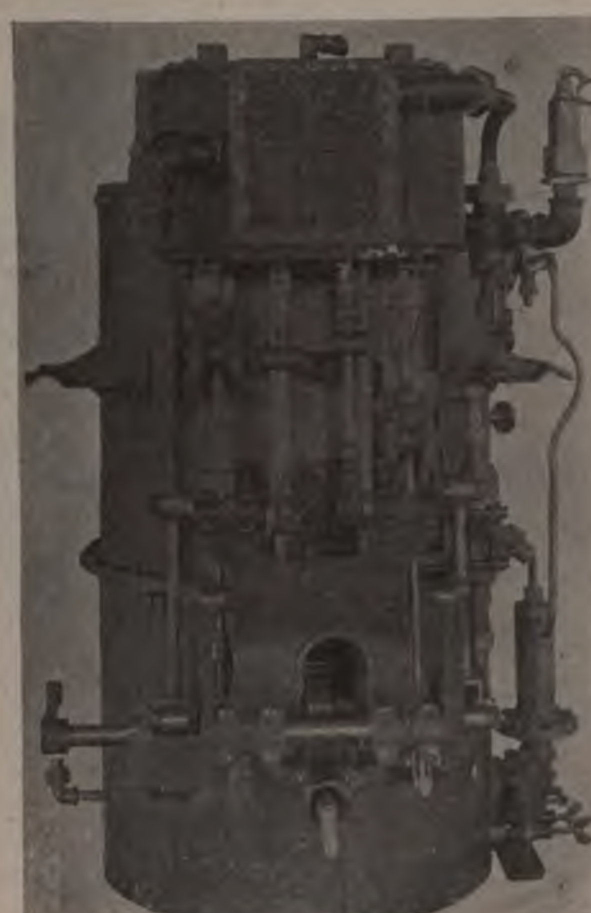


SIDE VIEW OF BOILER AND ENGINE, SHOWING CUT-OFF.

inlet, three gauge cocks, glass water column with automatic shut-off valves to prevent the escape of steam and water from the broken glass, and an auxiliary hand feed pump and an in-



FRONT VIEW OF BOILER.



BACK VIEW OF ENGINE, BOILER AND BURNER.

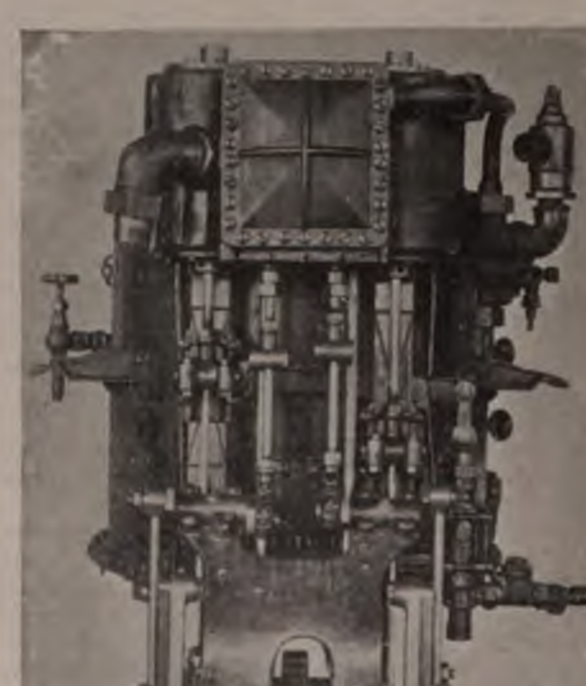
jector for the supply of feed water, in addition to the power feed pump attached to the engine. The hand pump underneath the wagon is used to get up steam, the (locomotive) injector to force water in when the wagon is at rest with steam up and the power pump when the wagon is moving.

The burner is 14½ in. in diameter and 11½ in. deep, and contains a copper coil through which the feed water is pumped before entering the boiler. The pipe supplying gasoline to the jet distributer passes across the burner. The heat from the fire vaporizes the fuel and the jet of vaporized gasoline is blown into the bottom chamber of the burner, drawing with it a supply of air for its combustion. This mixture of gasoline vapor and air rises through small annular openings in the top of this bottom chamber and burns with a colorless flame in the upper part of the burner in contact with the lower tube sheet of the boiler. Within each of the annular openings through the bottom chamber is a tube furnishing an additional supply of air. The supply of gasoline vapor is blown into the burner through three jets. The center jet, or torch jet, is always burning beneath the supply or vaporizer tube, but does not give heat enough to materially raise the steam pressure in the boiler when the two other jets are extinguished. The two remaining jets are controlled by a diaphragm regulator actuated by the pressure in the boiler. When the pressure is raised to the required amount, the supply of vapor is automatically shut off, and is automatically turned on again when the pressure falls. The burning torch jet always relights the other jets when they are opened by the diaphragm regulator.

The pressure at which the diaphragm regulator closes can be changed by a regulating screw. The weight of the burner, with its feed water coil, and lining of asbestos, and with the vaporizer tube and diaphragm regulator, is 49 lbs. The construction is such that a back flame is impossible, avoiding the danger of fire.

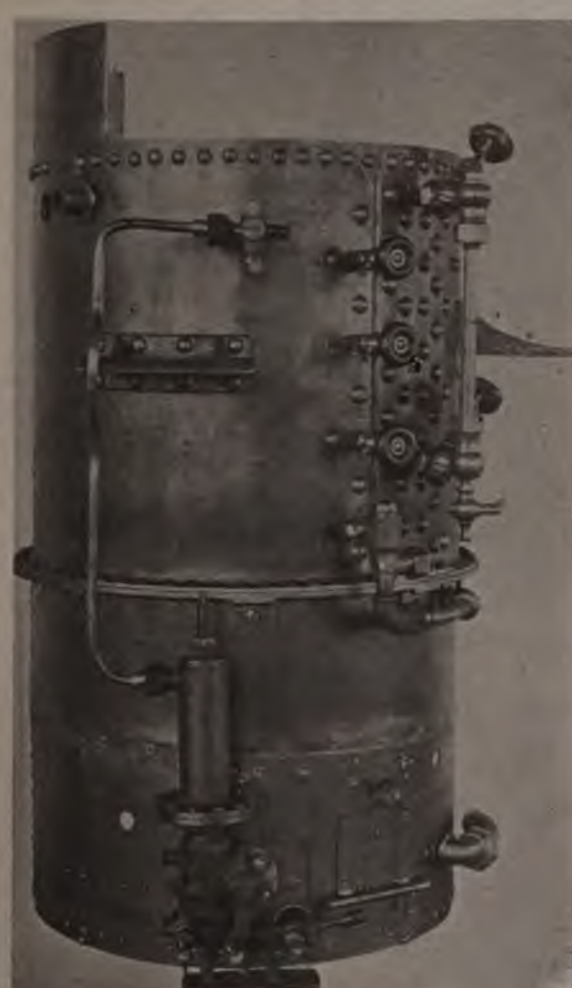
The top or body frame, which supports the boiler, engine and carriage body, weighs 50 lbs., and is made from solid drawn steel tubing with all joints pinned and brazed. The side bars are 1¼ in. outside diameter and No. 12 gauge or .109 in. thick. The end cross bars are of 1½ in. diameter and No. 12 gauge or .109 in. thick. Connections to the springs are steel forgings pinned and brazed to the tubes. The lower frame, which carries the springs and axles, is made of solid drawn steel tubing. The side bars, middle cross bar and front cross bar are of 1½ in. outside diameter and No. 12 gauge or .109 in. thick. The rear cross bar is 1⅞ in. outside diameter and No. 12 gauge or .109 in. thick. The diagonal frame braces are of steel tubing ⅞ in. outside diameter and No. 14 gauge or .083 in. thick, and have forged ends brazed into the tube.

The rear axle is hollow and is of 1¾ in. outside diameter, with 1 1-16-in. hole through it. One driving wheel is firmly fixed to this axle, while the other is fixed to a sleeve running loose upon it. Both axle and sleeve are connected through the usual compensating gearing. The large sprocket wheel carries four bevel pinions which mesh into two bevel gears on the axle and axle sleeve.



BACK VIEW OF ENGINE AND BOILER.

The rear axle is fitted with roller bearings to carry the weight of the carriage. All hubs are made from solid drawn steel tubing with forged flanges brazed on. The spokes are headed hot to avoid the breaking off of the heads, which often happens on spokes that are headed cold. Rims are of No. 12 steel with brazed butt-strapped joint. The tires are 2½-in. diamond pneumatic.



SIDE VIEW OF BOILER AND BURNER, SHOWING THERMOSTAT.

The carriage is furnished with two band brakes working upon bronze brake wheels 9¾ in. in diameter. One of these brakes is attached to each driving wheel. The brakes are actuated by a foot lever, which is a forging pinned and brazed to the cross-connecting shaft. The weight of the front wheel without tire is 16 lbs., and with the tire 26½ lbs. The weight of rear wheel without the tire is 20 lbs., and with the tire 36½ lbs. The wheel gauge is 4 ft. 8½ in. and the wheel base 5 ft. 4 in. The outside diameter of the front wheels is 34 in. and the outside diameter of the rear wheels 38 in. The driving chain is 72 in. long, weighs 8 lbs. and if of a pattern which will run quietly and safely, even when worn considerably, and when considerably out of pitch. Both chain and engine sprocket are hardened. The steering handle of the carriage controls the supply of steam to the engine, and also reverses the engine. The capacity of the water tank is 22 gals. or 18 to 25 miles.

The capacity of the fuel tank is 8 gals. or 70 to 100 miles. The weight of the carriage is about 1,050 lbs., or 1,200 lbs. with all supplies on. It is furnished with two side lamps and boot and with either canopy top or folding hood top.

The Ofeldt Steam Carriage.

This carriage was constructed by Ernest G. Ofeldt, of F. W. Ofeldt & Sons, Brooklyn, N. Y., the well-known manufacturers of vapor launches.

The motor is a compound vapor engine similar to the one used by this firm in its launches. The generator is placed across the carriage body behind the dashboard and really forming part of it. It is constructed of coils of copper pipe, brazed together and arranged in such a manner that great heating surface is obtained. The generator has been tested to 1,000 lbs. pressure. The fuel is stove gasoline burned in an atmospheric burner, producing a blue Bunsen flame of high intensity. The engine consists of two compound engines, having cylinders 1½ x 3 x 3 in. stroke, and cranks set at 90 deg. All the bearings and working parts are extremely large and ample wearing surface is provided. The engine is fitted with a reversing attachment and is fully under control of the operator at all times. Speeds ranging from 3 to 25 miles an hour are obtainable at will, and can be maintained for hours. The wheels are 28 x 2½ in., with ordinary tandem tires.

Enough fuel and water can be carried, it is claimed, for a run of 45 miles. The cut illustrates the inventor's experimental product. It is not a thing of beauty, but was constructed merely to demonstrate the practicability of the power. Its total weight is 400 lbs. Carriages of more elaborate design are now being constructed and will be on exhibition in a few months.

The machinery has been subjected to all kinds of hard usage, and Mr. Ofeldt assures us that under all conditions of road and weather it has performed all that was expected.

The Thomson Steam Carriage.

The Thomson steam carriage weighs 1,350 lbs., has a wheel base of 6 ft. and a tread of 5 ft. The front wheels are 33 in. and the driving wheels 36 in., two sets of wheels being employed, one wire suspension with pneumatic tires, and the other wooden wheels with solid rubber tires. Each driving wheel is provided with a powerful brake.

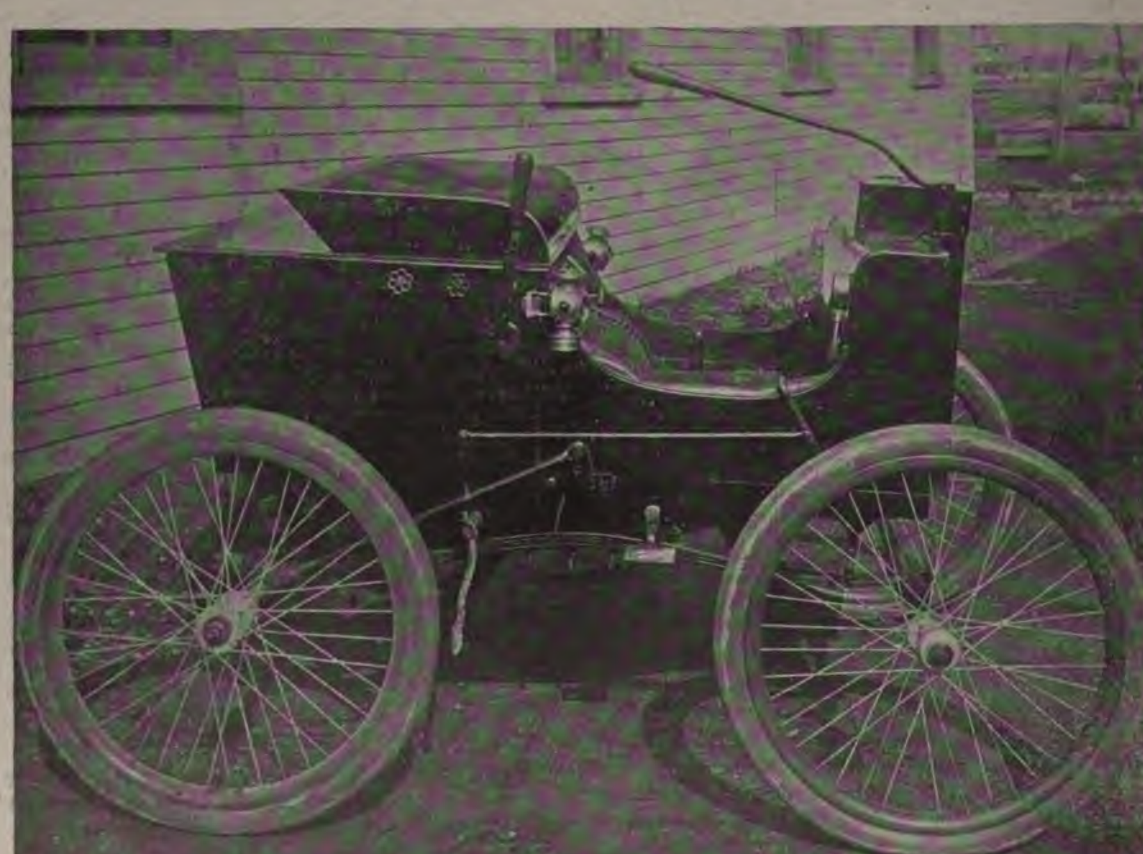
The steering wheels are always locked in any position in which they are left by the steering handle by means of a hydraulic check of the same construction as that described in The Horseless Age of September, 1898.

The present engine has four single-acting cylinders geared to an intermediate shaft carrying differentials, and from that by chains and sprockets to each driving wheel. The engine has poppet valves, exhausts through holes in the cylinder wall and is governed manually by a cam shaft, which gives a variable cut-off and reversal.

The kerosene oil is kept in a tank under low pressure and pumped automatically into the burner according to the demands of the service. The carriage will run thirty miles on one charge of water and oil, has climbed 20 per cent. grades and attained a speed of twenty-five miles an hour on the level.

The Riker Electric Vehicle Co., of Elizabethport, N. J., have taken nine spaces at the coming Cycle and Automobile Show at Madison Square Garden.

STEAM CARRIAGE OF PROFESSOR ELIHU THOMSON.



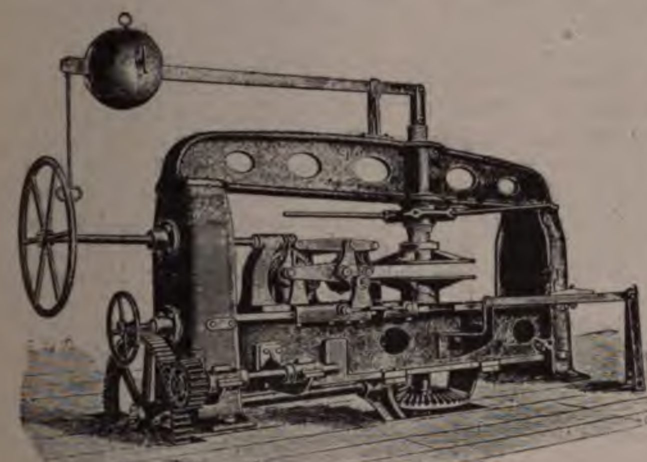
STEAM CARRIAGE OF ERNEST G. OFELDT, BROOKLYN, N. Y.

MACHINERY and TOOLS for motor vehicle builders

Readers using information from this department are requested to give credit.

Machine for Flanging Boiler Heads.

A new machine of interest to boiler manufacturers is the boiler head flanging machine shown here. It is adapted to all sizes of heads from 12 to 90 in., and requires no hole to be punched in the center of the sheet, and no formers, except for heads below 25 in. The machine consists of a bed resting at its ends in two uprights, whose upper ends carry a cross beam. Near the center of the bed is a vertical spindle carrying a table on top and driven by a gearing underneath. Passing through the upper beam and exactly in line with the spindle below, is a heavy screw to whose lower end is fastened the clamping plate by a swivel joint. A large capstan nut serves to operate this screw. To one side of the table is placed an adjustable slide carrying a vertical roller, which can be clamped at a distance from the center to the outside of the roller equal to the radius of the head to be flanged. Next to this slide is another,



carrying a system of links by means of which a housing with its contained roller can be swung from a horizontal to vertical position in a true circle arc around a predetermined center. This slide is so clamped to the bed that this center coincides with the center of the bed of the vertical roller. The hot sheet coming from the furnace is run onto the table, being centered by adjustable stops. The clamping plate is pushed down by means of the pendent handle at the end of the long lever connected to the upper end of the screw, and the sheet clamped by a few turns of the large nut. The edge of the sheet projects over the outside of the vertical roller, by the amount of the flange of the finished head. The machine is now set in motion, revolving the plate rapidly, and the flanging roller carried by the links is slowly made to travel from its horizontal to a vertical position by means of the worm and worm wheel and the large hand wheel outside the upright. This causes the roller to bear against the upper side of the sheet, spinning it down over the vertical roller until the flanging roller has reached a vertical position, and the head is finished.

The machine is manufactured by A. Falkenau 109 North Twenty-second St., Philadelphia, Pa.

Seamless Cold Drawn Steel Boiler Tubes.

The Shelby Steel Tube Co., of Cleveland, O., wish to call the attention of builders of vehicle boilers to the advantages of seamless cold drawn steel tubing for boiler tubes. According to the reports of the Hartford Steam Boiler Inspection & Insurance Co., the largest percentage of defects in boilers they inspected were due to "serious leakages around the tube ends," and many of these were rated "dangerous."

This leakage is mainly due to unequal expansion and splitting or crack of the tube in expanding, or re-rolling the tube where it enters the tube sheet of the boiler. The cause of this, it is claimed, can be traced to the quality of material used, imperfect weld, faulty workmanship or design.

It is difficult to control the analysis of puddled or bloomed iron, and this variation of analysis in the best iron tubes must certainly have its effect on the quality of the tubes.

The heating and reheating in the rolling and welding operations, together with the difficulties attending the securing of a perfect weld, with varying conditions of temperature and different thicknesses of metal, make it difficult to secure a tube free from objectionable properties. Seamless cold drawn steel tubing overcomes most of the difficulties and objections encountered in lap welded tubing. The very best grade of material must be used in its manufacture. The original round billet (when same is made direct from solid form) must be free from laps, seams, pipes, blow holes and other imperfections, and must be of such a nature that it can be cold drawn and easily worked. These combinations of qualities can only be obtained from the most carefully selected stock, manufactured in the most particular manner. In the method of manufacture pursued by the Shelby Co. there is only one heating (with the exception of annealing) from the original solid form to the finished tubing, and it would be impossible to manufacture tubing from material containing any flaws or physical imperfections, as these would become apparent in either the piercing or cold drawing operation. Hence the original life and physical properties of the metal are not destroyed and there is an absence of imperfections or defects that arise from imperfect weld or faulty fabrications in lap welded tubing.

Cold drawing renders the tube dense, tough and exceedingly ductile, smoother in finish, stronger and more durable.

The greatest objection offered to the use of steel tubing is its increased tendency to corrosion and pitting over iron tubing. This pitting of lap welded iron and steel tubing generally begins, and is most active, at and in the immediate neighborhood of the weld. This is due to the objectionable features and qualities incident to the welding operation, for it will be generally conceded that the subjecting of iron or steel to a welding heat will render it liable to take up impurities, in both heating and welding, not desirable in boiler tubing.

The British Admiralty approves of the use of seamless cold drawn steel tubing and the United States Navy has nearly all of her torpedo boat boilers of the Thornycroft and Yarrow types fitted out with seamless steel tubing. Railroads are using it in locomotives with gratifying results. Builders of stationary boilers of both water and multitubular type are beginning to see its advantages, and all indications point to its being generally used in all high grade boilers within the next few years.

LONDON NOTES.

London, Nov. 16.

EMANCIPATION DAY.

The fourth annual meeting of the Motor Car Club took place on Monday, the cars assembling at the Hotel Metropole. The meet was a very successful one, no less than 105 vehicles of every type and design participating. The destination chosen was Brighton, mainly by reason of the fact that this seaside resort was visited on the occasion of the first run of the club in 1896. The object the club had in view was to enable the public to form a comparison as to the two runs, and thus note the improvement that had taken place in motor vehicles. In 1896 the exhibition was not altogether good. The entries were small and many breakdowns occurred on the road. The start was made about 11 o'clock, and out of 105 vehicles 95 completed the journey. The first—a motor tricycle—to reach Brighton did so at 2:15, the other vehicles following at intervals up to 7 p. m.

In the evening a grand banquet was held, at which over 200 persons were present, and at which many speeches anent the progress of the motor industry were made.

C. Oppermann, of Wyngatt St., Clerkenwell, London, E. C., is busily engaged on the designs of two electric dust vans for the corporation of the city of London. Mr. Oppermann has also just adopted a new method of gearing the motor to the rear axle.

THE RICHMOND SHOW.

The report of the judges on the exhibits at and trials in connection with the Automobile Club's show at Richmond in June last has just made its appearance. The judges' report extends to about eight pages. Part II. is devoted to the awards, while Part III. gives the results of the hill climbing and distance trials organized in connection with the exhibition. These were, of course, dealt with in these columns at the time, but the report just published would no doubt be useful to many builders of automobiles in America, full particulars being given of the vehicles which took part in the trials.

THE LONDON ELECTRIC CABS.

A rumor has reached me this week that an American syndicate—not unconnected with the New York electric cabs—is negotiating for the property of the London Electrical Cab Co., whose vehicles are at present conspicuous by their absence.

SHOW QUESTION.

I have already alluded in former letters to the two motor shows, one organized by the Automobile Club and one by Cordingley & Co., proprietors of The Motor Car Journal. Builders of automobiles here have been agitating against two shows, and as there is no question as to which was the better of the two held during the last summer, the Automobile Club has given up the idea of organizing an exhibition on its own account. At a meeting of the club and of manufacturers held this week it was stated that inasmuch as Mr. Cordingley had met the club fairly in the matter and was willing to throw in his lot with them, an arrangement had been made by which the exhibtiion would be called the Automobile Club's Exhibition, and be held at the Agricultural Hall; the club would have the direction and Mr. Cordingley would be business manager. The club would have nothing to do with the finances, except to receive a certain sum from Mr. Cordingley and to find the prizes in connection with the trials. The question of space would be under the control of the club, but the general arrangement would leave it free to exercise its energies in other directions.

THE AUTOMOBILE CLUB'S CELEBRATION.

The following day, Tuesday, to celebrate the completion of the third year since the passing of the Light Locomotives on Highways Acts, the members of the Automobile Club had a run to Sheen House, Richmond, a journey of about 18 miles out, and home. About 60 vehicles met at Whitehall Court, where the club is situated, and all reached Sheen House without mishap. The ease with which the vehicles of every type threaded their way through the traffic and darted through the narrowest of openings which no horse-drawn vehicle dare have ventured, was a revelation to many of the bystanders.

Altogether the display was a striking demonstration of the capacities and ease of control of the self propelled vehicle, even in the thickest of West End traffic, while Monday's extended ride to Brighton equally established the same qualities on country roads. Taking the two runs together, the dead failures did not amount to 2 per cent., with the partial failures in about equal proportion; and when so large a total as 160 vehicles is concerned, the evidence is of no small value. The annual banquet of the club was held in the Hotel Metropole the same evening.

The horse-power test of motors organized by La Locomotion Automible is now in progress. The entries include 46 carriages, 7 voiturettes, 7 motor cycles and 14 motors.

MOTOR VEHICLE PATENTS of the world

UNITED STATES PATENTS.

(*Continued from last issue.*)

The delivery port J^2 leads through a valve box, J^3, also provided with a non-return valve, J^4, and through a second valve box, J^7, into the pipe K′. A port, J^9, connects the valve boxes J^3 and J^7 through a port or passage which is normally held closed by a valve, J^8.

L indicates the plunger working in the cylinder J and connected by means of a universal joint (indicated at L′), with a plunger rod, L^2, which in turn connects with the lower end L^3 of a lever, L^3 L^4, pivoted at L^5, and the upper end L^4 of which is in convenient reach of the driver's seat. The valve J^8 is connected with a stem M, having secured to its free end a downwardly extending arm, M′ (see Fig. 2), having rearwardly extending arms, M^2 M^2.

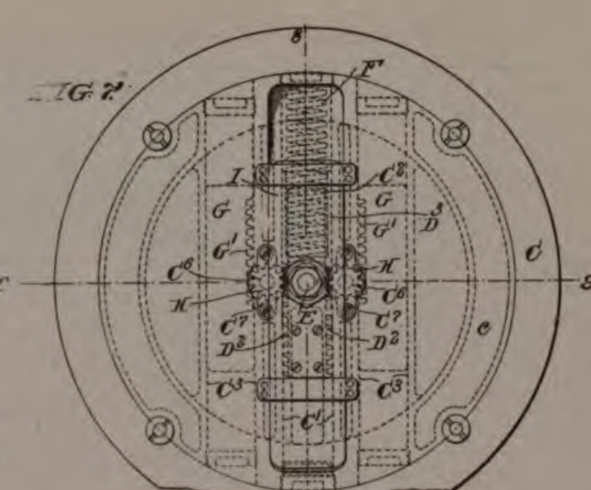


FIG. 7

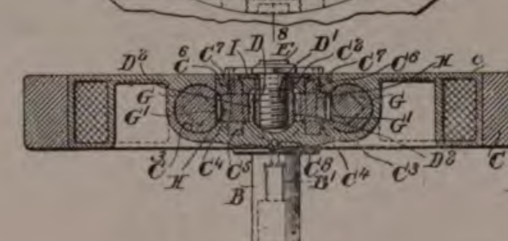


FIG. 9

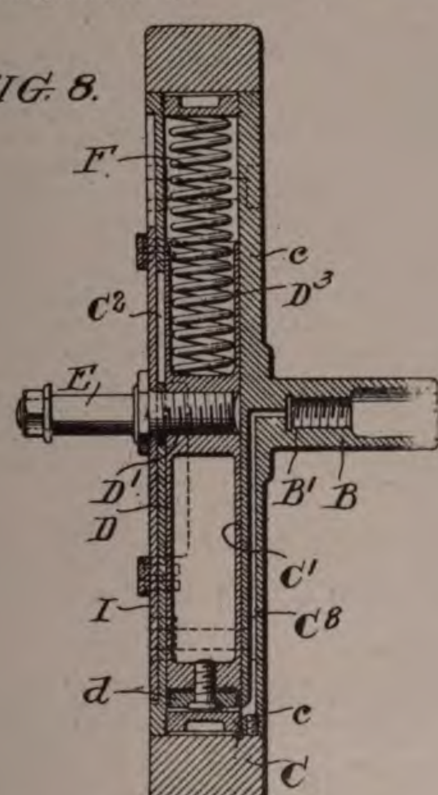


FIG. 8.

M^3 is a shaft secured in bearings firmly connected with the pump cylinder J and having at one end a cylindrical portion, M^4, which lies between the arms M^2 M^2 and an upwardly extending lever arm, M^5, as well as a cam (indicated at m^6), which presses against the portion of the arm M′ lying between the arms M^2 M^2. At the other end of the shaft M^3 is secured the hub M^6 of a lever, M^7, which in turn is secured to a rod, M^9, connected at its upper end with a lever, M^{10}, which, as shown, is a foot lever and is easily reached from the driver's seat. To the upper end of the lever M^5 is secured a rod, M^8, which runs backward under the wagon body, and is connected with a lever, M^{11}, to which is fastened a brake band, M^{12}, working on a brake drum, Q^{22}.

When the operator desires to move the crank pine E outward from the center of its disk and thus to increase the throw of the clutches controlled by it, he moves the lever L^4 L^3 so as to operate the plunger L, drawing fluid, which will conveniently be oil, from the reservoir k through the pipe K and the valve J^3 into the cylinder J, and forcing it out through the port J^2 and valve j^3 into the conduit K′, and thence through the passages described into the cylinder in the crank-pin disk. When, on the other hand, he desires to arrest or lessen the stroke of the clutches, he places his foot on the foot lever M^{10}, moving the lever M^7 downward and rotating the shaft M^3 toward the left. This motion of the shaft presses the cam m^6 against the rod M′ and pushes it and the rod M inward through the rod M, lifting the valve J^8 from its seat and permitting the flow of the liquid backward from the pipe K′ through the valve box J^7 and port J^9 into the reservoir, the force of the spring in the crank disk, as soon as the hydraulic pressure is relieved, forcing the crank pin back to its central and inoperative position. At the same time in the construction shown the movement of the shaft M^3, acting through the lever M^5, rod M^8 and lever M^{11}, applies the brake to the rear or driven axle of the vehicle.

No. 637,299—Oil Vaporizing Device for Gas Engines.—Geo. S. Strong, New York, N. Y., assignor to John P. Murphy, Philadelphia, Pa. Filed Dec. 24, 1898. Serial No. 700,277. (No model.)

The exhaust gases from the engine pass through the port B in the casting A into the chamber S, formed on the inside of the pipe D, and from said chamber they pass into the muffle chamber U, the perforated diaphragms in said chamber performing

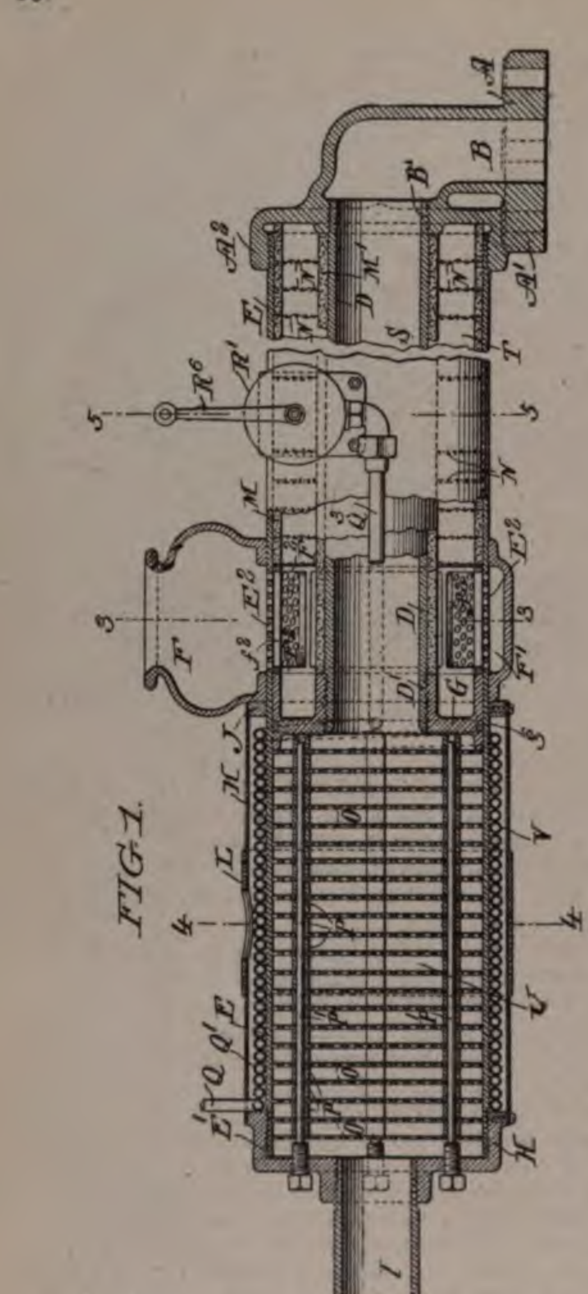


FIG. 1.

their well-known function of deadening the noise of the exhaust, and also performing the additional function of conveying the heat of the exhaust gases to the metal wall of the chamber U, formed by the pipe E, with which pipe the diaphragms are in close metallic connection. From the muffle chamber U the gases escape through the pipe I. The air forming a portion of the explosive charge of the engine is drawn in through the casting F and through the perforation G^2 in the pipe E into the chamber T, passing through all of the perforated partitions N, and finally being drawn into the engine through the ports C C. The oil which it is desired to vaporize and mix with the air coming from the supply pipe Q passes through the coils Q′ situated in the chamber V, and which are in close metallic contact with the heated metallic wall of the chamber U. The oil in passing through the chamber V is therefore highly heated and delivered in this condition to the spraying device R′, which admits the oil, of course under considerable pressure and in a fine spray, into the chamber T, the spraying device being arranged to throw the oil into the chamber in a direction substantially perpendicular to a radial line of the annular chamber. The sprayed oil is thoroughly mixed with the air by the action of the sprayer, and also of the multiple diaphragms N N, etc., through which the air and vaporized or sprayed oil pass before they reach the admission ports C C.

The function of the gated openings K′ K^2 in the chamber V is to provide a means for heating the oil when the engine is first started and before the exhaust gases have had an opportunity of heating the muffle chamber and through it the coils of oil admission pipe. By moving the ring L so as to open the passages K′ and K^2 the flame of a Bunsen burner, W, or similar lamp can be thrown into and substantially around the chamber V, so as to heat the coils of pipe U′ and the oil passing through it. This need only continue until the exhaust gases have had time to heat up the muffle chamber to the proper point, when the lamp may be withdrawn and the gates closed.

COMMUNICATIONS.

"The Insolence of Office."

Philadelphia, Nov. 29.

Editor Horseless Age:

In the test of the regulation of the Fairmount Park Commission much more is involved than the mere question of whether or not the park or certain roads of the park shall be closed to automobiles. The case before us is not one created intentionally. It was quite accidental and the result of inadvertence and insufficient knowledge of a rather vague regulation on one part and on the other part undue, heedless, indiscreet severity.

The real issue is to restrain the "insolence of office."

Our guards are vested with power necessarily, and by reason of the very rare appeal from their actions, little by little they lose the sense of fitness in the enforcement of rules. More than this, there is involved a resistance to high-handed, unauthorized, unlawful police violence against the public. And still deeper there is a laying bare of the ill-considered, crude legislation from which we suffer so much. The laws drafted ordinarily, when they are under fire, are shown up to be vague, ambiguous and really unenforceable.

Respectfully yours,
JULES JUNKER.

Automobile Club's Permanent Headquarters.

The Board of Governors of the Automobile Club of America held a meeting last Wednesday evening and voted to procure permanent headquarters at the Waldorf-Astoria. Accordingly a suite of rooms has been leased for a year, until the arrangements for a permanent club house are made.

Propositions from various parties scattered about the city who wish to store and care for automobiles were accepted, so that the motor house will not be necessary for the present.

Permission was given the club to use Astor Court, a private way, where hansoms and other vehicles are excluded, thus giving the members of the club the advantages of a private entrance to the Waldorf.

A complimentary letter was received from the French Automobile Club and an invitation was extended to any of the members of the American club to visit the French club house when abroad.

Two Passenger Phaeton. Price, $1,220.00.

GASOLINE

MOTIVE POWER

is what they use in France with Double Cylinder Balance Engines. We have the most perfect system on earth. **A Pleasure Trip from Kokomo, Ind., to New York, distance 1,050 Miles,** was made by one of our Phaetons at the **average rate of 14 miles per hour.**

The best record yet made in America and only slightly surpassed on the fine Boulevards of Europe.

We manufacture these carriages in TWO, FOUR and SIX Passenger capacity. We fill orders promptly and build HIGH CLASS CARRIAGES ONLY. We furnish circulars free, and our large catalogue for **10** Cents.

Order Carriages now for Spring delivery. If you wait you won't get one.

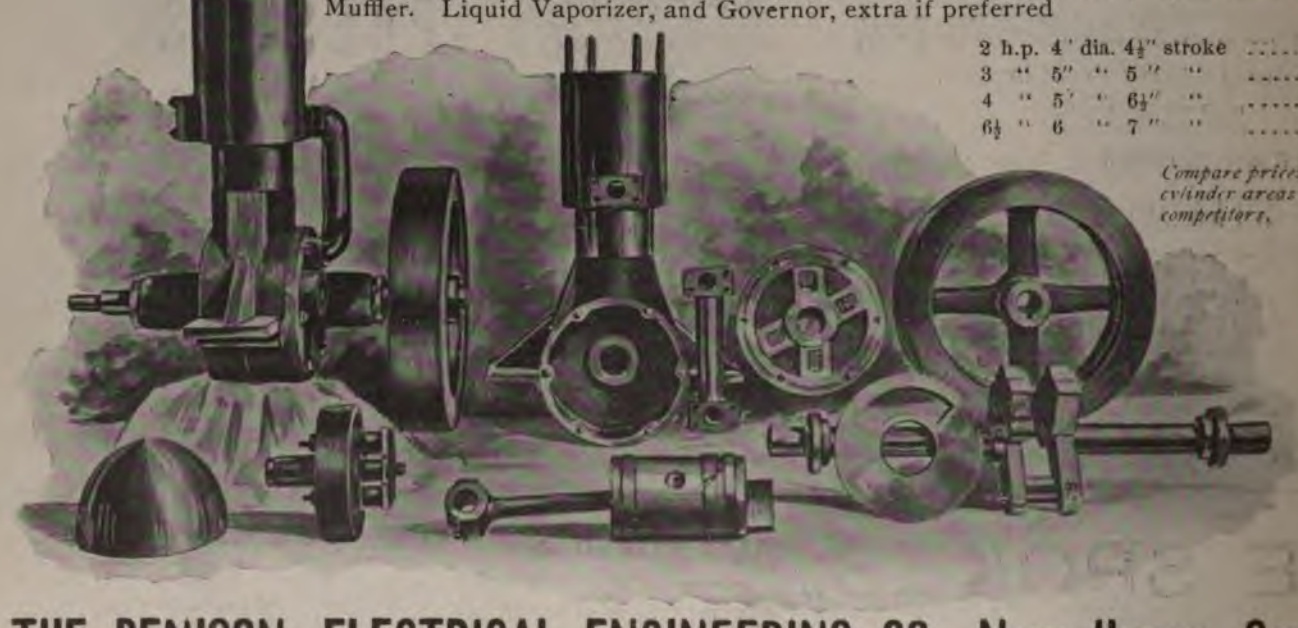
HAYNES-APPERSON CO., KOKOMO, INDIANA, U. S. A.

HERE IS A RELIABLE TWO-CYCLE ENGINE

IT WILL PAY YOU to investigate. For Launches, Full Water Jacket; for Carriages, Semi-Water Jacket. Write and ask what Semi-Water Jacket is. One, two and three cylinder, constant torque, minimum vibration, noiseless exhaust. Net Price for December on Single Cylinder Engines complete, including Carburator-Tank, Batteries, Spark-Coil and Muffler. Liquid Vaporizer, and Governor, extra if preferred

2 h.p.	4" dia.	4½" stroke		$75
3 "	5" "	5" "		100
4 "	5" "	6½" "		135
6½ "	6 "	7" "		175

Compare prices and cylinder areas with competitors.



THE DENISON ELECTRICAL ENGINEERING CO., New Haven, Conn.

CAUTION.

Pneumatic Tires for Automobiles or Vehicles.

All persons are notified that I am the owner of the

TILLINGHAST PATENT,

(Number 497,971, of May 23, 1893, for Improvements in Pneumatic Tires.)

which, after four years of litigation, has been sustained by the United States Court, in a decision by Judge Colt, on November 14, 1899.

This Patent covers all single-tube tires used for any purpose whatsoever, including the great majority of automobile or vehicle tires; and no person can make, sell or use any such tires without a license from me.

No license on automobile or vehicle tires has as yet been granted, and

ALL PERSONS ARE WARNED

that any infringement of the Tillinghast Patent by the manufacture, SALE or USE of such tires will be prosecuted to the full extent of the law.

Upon all Single-Tube Tires for automobiles or vehicles MADE, SOLD OR USED in the past, a royalty must at once be paid to me.

☞ **The undersigned believes it wiser to rely on the opinion and decree of a Judge of the United States Court, after nearly a year's mature consideration of evidence, briefs and arguments, than on the opinion of any firm of lawyers whatsoever, and notifies the trade that he shall claim full damages for future infringements.**

THEODORE A. DODGE,

ROOM 1238, N. Y. LIFE BUILDING NEW YORK CITY.

WE beg to announce that we have about completed our new Automobile Plant and that we have entered into the practical manufacture of motor vehicles of the

Daimler-Phenix and Panhard and Levassor SYSTEMS

THE

STANDARD AUTOMOBILE SYSTEM OF THE WORLD.

We will have our CARRIAGE CATALOGUE ready about February 1, and be ready to accept ORDERS about February 15, 1900.

DAIMLER MFG. CO.,

GENERAL OFFICE AND WORKS, STEINWAY, LONG ISLAND.

Sole owners of the Daimler and Panhard-Levassor Systems for the United States and Canada.

BOILERS AND ENGINES

FOR VEHICLES.

STEAM CARRIAGES.

Carriage Boiler, Class A.

STEAM CARRIAGE, DOS-A-DOS STYLE.

Engines and Boilers Built to Order.

Also Steam Delivery Wagons and Omnibuses

Carriage Engine, Class B.

EDWARD S. CLARK,

SEND STAMPS FOR CIRCULARS.

272 Freeport St., Harrison Square, Boston, Mass.

PNEUMATIC :: :: MOTOR TIRES.

This is the construction which has proved a

WINNER

LOWEST COST PER MILE.

Results of three years' experience, and we have more tires in actual operation than all others combined.

MADE IN AKRON, OHIO,
BY

THE DIAMOND RUBBER COMPANY.

The "A.R.B."

NO BALLS TO CRUSH
NO CAGES TO WEAR OUT
NEEDS NO ATTENTION

IS THE BEST AXLE BEARING FOR

MOTOR VEHICLES

It combines an AMPLE ROLLING SURFACE *with a* PURELY ROLLING ACTION *For* DURABILITY AND ECONOMY OF POWER

IT IS UNEQUALLED

The FOREIGN PATENTS ARE FOR SALE

American Roller Bearing Company

27 STATE STREET
BOSTON, MASS.

SEND FOR CIRCULARS

Factory: 32 to 40 BINFORD STREET

STOP THAT NOISE!

NEW PROCESS

RAW HIDE PINIONS WILL DO AWAY WITH IT.

WEAR WELL AND TAKE NO OIL, HENCE . . . .

NO GEAR CASE NEEDED.

THE NEW PROCESS RAW HIDE CO.
SYRACUSE, N. Y., U. S. A.
Patentees and Sole Manufacturers.

FOR AUTOMOBILES

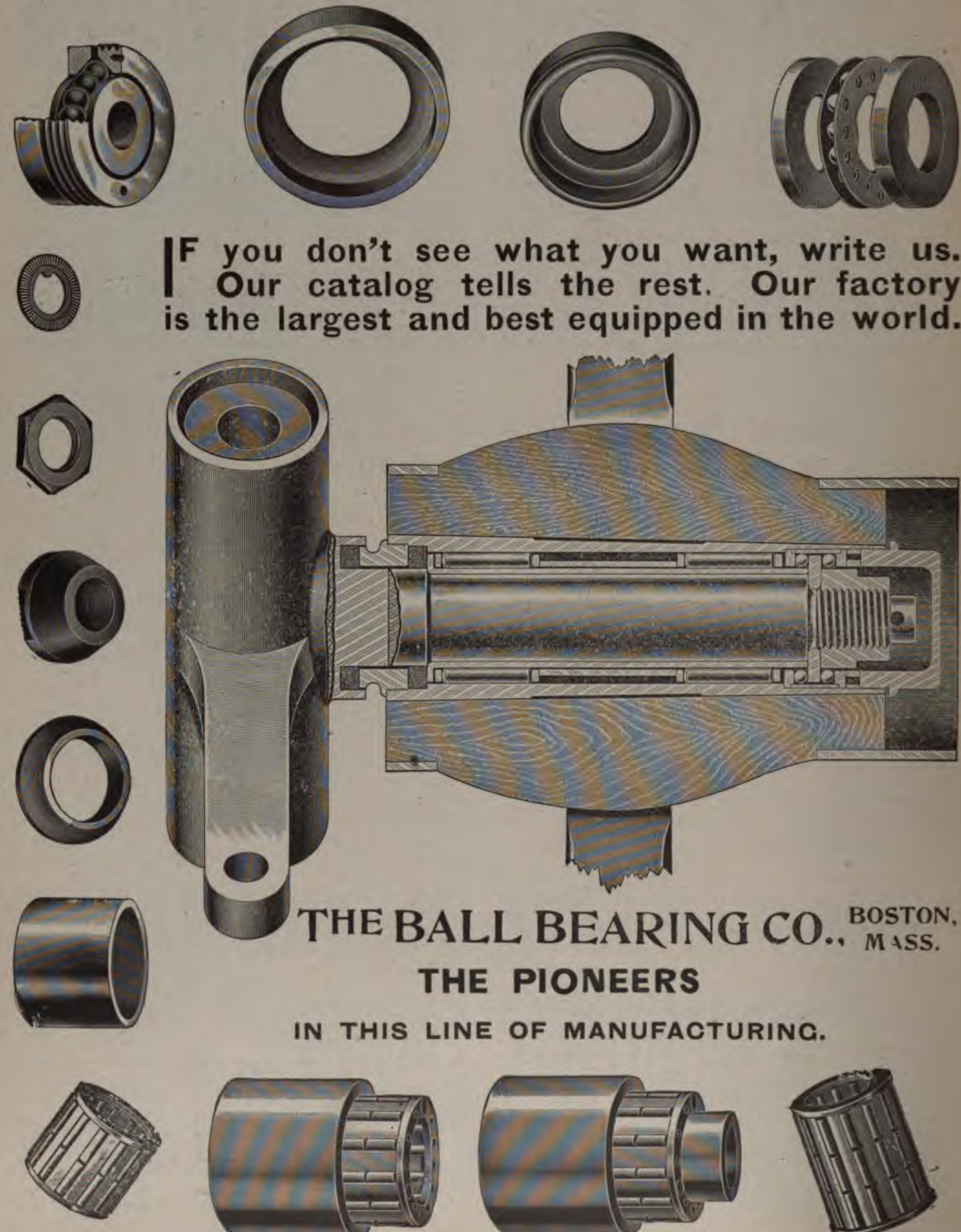
AND GASOLINE LAUNCHES
USE THE EDISON LALANDE BATTERIES.

LIGHT WEIGHT AND LIQUID TIGHT

CONSTANT CURRENT AND NO WASTE WHEN IDLE.

FULL DESCRIPTION IN BOOKLET NO. 5

EDISON MANUFACTURING COMPANY,
THOMAS A. EDISON, PROPRIETOR. 135 FIFTH AVENUE, NEW YORK.


IF you don't see what you want, write us. Our catalog tells the rest. Our factory is the largest and best equipped in the world.
THE BALL BEARING CO., BOSTON, MASS.
THE PIONEERS
IN THIS LINE OF MANUFACTURING.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS

VOL. V. NEW YORK, DECEMBER 13, 1899. No. 11.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. L. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

Explosive Motor Number.

On Jan. 17 we shall issue an Explosive Motor Number, devoted exclusively to gasoline, kerosene, alcohol, etc., vehicle motors and motor vehicles. Readers who have anything new in this line are invited to communicate with the editor at once. The Explosive Motor Number will contain not less than 64 pages, and in point of merit of contents will equal if not surpass any publication so far issued in the motor vehicle line. Ten thousand copies will be printed, but the advertising rates will not be increased. Inasmuch as nearly the entire edition will be sold—as all the editions of The Horseless Age are—this will probably be the cheapest advertising ever offered by a trade journal. Order space and copies now.

Light Carriages.

Reports from England and France show the increasing popularity of the light carriage or voiturette. Many bicycle manufacturers in the former country are turning their attention to the manufacture of these medium priced little runabouts, in weights varying from 400 to 600 lbs. Machines of similar weight and construction are beginning to be turned out on this side of the Atlantic and are finding as ready a market here as on the other side. In many cases these machines may give a fairly good account of themselves if they are confined to smooth roads and are carefully used; but for touring and general knocking about they cannot be expected to give satisfaction. The necessary weight and strength are lacking, and accidents and breakdowns are quite sure to result if they are subjected to rough usage.

The difference in the roads, particularly in the rural districts, must be taken into account by the manufacturer of light motor carriages for the American market. The bicycle, with its vertical strains and its restriction to good roads or paths, is not a safe model for the motor carriage builder. The motor carriage, from the very fact that it has four wheels and is a road machine, calls for entirely different construction. The present danger with which the motor vehicle trade is confronted in America is flimsy guesswork construction, imitated from the bicycle and wholly inadequate for the four-wheeled vehicle.

Steam Vehicle Licenses.

The New York police authorities are setting the pace for the country in reference to the licensing of operators of steam vehicles. During the past two or three weeks quite a number of engineer's licenses of the third class have been granted to aristocratic New Yorkers who own pleasure carriages provided with vertical shell boilers. Applicants for such licenses are required to undergo a superficial examination in the construction and care of such boilers, but the inspection of the boilers

themselves seems to be rather formal so far. A rigid inspection of vehicle boilers will without doubt be demanded soon, and manufacturers of steam vehicles should prepare themselves for it by a closer examination of the requirements of safety in shell boilers of this class. As suggested by Mr. Clegg, they might with great advantage to themselves and the public take some good boiler insurance company into their confidence. Abundant data are to be had for their guidance.

Condensation.

No little attention has been centered upon condensation by American steam vehicle inventors. The free escape of the exhaust into the air is generally regarded as a public nuisance not to be tolerated by the law, because of its liability to frighten horses, and ingenious devices have been contrived to prevent this escape of steam upon the highway. The majority of them, however successful they may be, are more or less complicated and expensive, and whether any but the simplest methods will ultimately be found necessary is a moot question.

Horses will soon get accustomed to the sight of steam issuing from wagons. Unless it poured forth in clouds and along congested thoroughfares it would constitute no hindrance to traffic. A voluminous escape of visible steam could hardly occur except in cold weather and on a hill where engines were working under heavy pressure, and as these conditions are rarely coincident the need of refined methods of condensation would appear to be only temporary and largely imaginary. Mechanical refinements and complications which are devised for unusual conditions and only limit the ordinary usefulness of a machine are soon discarded in practice.

Efficiency.

The efficiency of an engine depends largely upon fixed or uniform conditions of operation, producing what is called constant load. In motor vehicle work the conditions are constantly changing and the load varies with them. We have unloaded vehicles, loaded vehicles, starting, climbing grades, etc., to which the power must accommodate itself. To attain the high degree of flexibility required, therefore, we must sacrifice efficiency somewhat. A vehicle engine or motor cannot compare with a stationary engine in efficiency, other things being equal.

Speed Regulation in Paris.

Paris automobilists are said to be enraged at the new speed regulations imposed by the Municipal Council, which restricts the rate in the Bois de Boulogne, the principal park, to 7½ miles an hour, or less than the maximum allowed to horse vehicles.

This exhibition of righteous indignation comes with bad grace at this late day, inasmuch as the present restrictions are the direct result of the mad escapades of the members of the Automobile Club over the common roads of France, the road races which it has continued to organize and patronize long after there was any reasonable excuse for them, and the general subordination of the commercial to the sporting side of the automobile in consequence of its course.

The Automobile Club of France has nothing to do but mend its ways and accept as inevitable the tardy regulation of the municipal authorities.

More Park Permits.

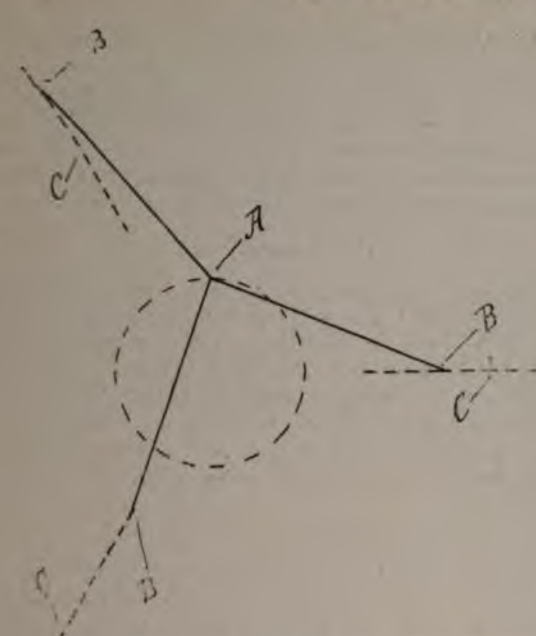
The president of the New York Park Board is issuing permits to automobile owners at the rate of two or three a week. So far, however, the permits have been limited to electric vehicles, gasoline carriages being barred as too noisy, not only in New York, but also in Baltimore as well. The electric vehicle is undoubtedly the park vehicle par excellence; but the exclusion of the gasoline carriage can scarcely be regarded as permanent. Once the gate is unlocked the throng is hard to stem.

Steam Boiler Number.

The Steam Boiler Number of Dec. 6 probably goes into the subject of steam road locomotion more thoroughly than any publication extant. It is selling very rapidly and the edition will soon be exhausted, although seven thousand copies were printed. It will long be regarded as a valuable work of reference and should be secured by all interested in road locomotion. The Explosive Motor Number will be an even more valuable treatise on that branch of the subject.

A Suggestion.

For some time past we have published considerable material dealing with gasoline engines. The balancing of moving parts, crank pin pressures and similar matters have received very interesting treatment from our correspondents, and the exchange of ideas, as well as the free discussion of the plans proposed, cannot but have had a most beneficial effect. The general trend of thought has been toward effecting an improvement by doubling up the single engine so as to have equal reciprocating parts traveling in opposite directions at the same time. Of course it is evident that cylinders may be arranged about the crank shaft in a variety of ways, and, so far as the



question of crank pin pressure is concerned, the three-cylinder engine, on the Brotherhood plan, presents an interesting study. In the figure, A = the crank pin, B the wrist pin and the dotted lines C C C indicate piston travel. The lines A B are the connecting rods attached to one common crank pin.

By comparing the pressures acting simultaneously at several points in the travel of the crank pin, one will realize why the arrangement has been presented for further study along the lines already considered.

Electric Vehicle of the United States Automobile Co.

The electric carriage shown herewith has a number of new features worthy of notice, one of which is a special motor, manufactured by the company, in which both the field and the armature revolve. The field is fastened to one driving wheel and the armature to the other through means of reduction gears, thus giving the independent speed of the driving wheel without the compensating gear.

Another important feature claimed is that the motor weighs considerably less than any other motor now in use. The 3 h.p. motor used in this illustration weighs but 125 lbs. The battery is suspended to the truck frame on independent springs, the carriage proper being mounted on ordinary light carriage springs, making a very easy riding carriage. The placing of the battery close to the ground, as shown, gives less sideways strain on the truck than if it were placed in the carriage body.

The steering wheel is provided with a central pivot, the steering handle having a clutch which holds the wheel firmly in any position in which the operator sets the steering handle. This is automatic and no attention is required from the motorman.

There are three forward and two backward speeds, the highest speed being 12 miles an hour. The carriage will run from 25 to 30 miles on good level streets on one charge.

It will be noticed that the driver's seat is placed very low, giving an almost unobstructed view to the passenger.

The carriage is fitted with a powerful band brake, capable of stopping the carriage in twice its length when going at full speed.

ELECTRIC CARRIAGE OF THE U. S. AUTOMOBILE CO.

LONDON NOTES.

London, Nov. 30.

TO BRIGHTON AND BACK IN A DAY.

The Automobile Club organized a run from London to Brighton and back on Tuesday last. The day was a glorious one, and about fifteen carriages and motor cycles put in an appearance. The run was most successful and pleasant, for although some trouble was experienced on the road in the London suburbs, the corriages got through without serious accident. The new Daimler Parisian car achieved remarkable success, the journey to Brighton (52 miles) being achieved without a single stoppage, the same remark applying to the return journey.

MORE AUTOMOBILE CLUBS.

At a meeting held in Manchester last week to form a Manchester branch of the Automobile Club of Great Britain and Ireland, Charles Johnson, the secretary at the headquarters in London, delivered an address on the subject of automobilism generally, and the advantages that would follow upon the establishment of a Manchester club affiliated with that already existing in London, which was now recognized as the English authority on the study and practice of automobilism. It was then decided by resolution to form a local club for social purposes, and for the encouragement of automobilism in the district. By a second resolution it was decided to affiliate the Manchester with the London club. A provisional committee, whose duty will be to take temporary premises and arrange among other matters for the appointment of a temporary secretary, was afterwards appointed. On Friday a meeting is to be held in Edinburgh with the view of forming a Scottish branch of the Automobile Club.

AN INTERESTING TEST CASE.

At Marlborough St. Police Court on Tuesday Mr. Moffat Ford, manager of the Motor Car Co., Ltd., London, was summoned for keeping a carriage without a license. Mr. Logan, an officer of inland revenue, said that on Sept. 21 he saw the defendant in charge of a four-wheel motor car and informed him that he would be summoned for keeping a carriage without a license. Mr. Ford, in defense, said the company, of which he was the manager, were in the habit of having motor carriages sent to them from Paris and various parts of England to sell on commission. He was in the habit of going short journeys on these cars to see if they were in proper working order, and the car in respect to which he was summoned was one that had been received by the company from Paris to sell. He contended that the company could not be made to take out licenses for cars that were sent to them to sell, and were merely taken short journeys in the streets to ascertain whether they were in working order. The magistrate, in givnig his decision, said that in the circumstances he did not think the defendant was bound to take out a license. A carriage builder might have in his shop window ten or a dozen carriages for sale, and the mere use of one of them for a trial trip would not, he thought, render the man liable to be summoned. The summons against the defendant would therefore be dismissed.

A BRITISH MOTOR MANUFACTURERS' ASSOCIATION.

An important and representative gathering of British manufacturers of motor vehicles and essential parts thereof was held in London last week, 30 gentlemen being present to discuss the advisability of forming a motor manufacturers' association for the protection of the trade and other matters. After an interesting discussion it was unanimously decided that such an association was urgently needed, and should be formed, and an organizing committee of twelve was elected from the gentlemen present to draw up a working scheme to be presented at another meeting to be called at an early date.

THE 1900 RACING SEASON.

The racing fever appears to be spreading among English automobilists, for I hear of many preparations for special carriages to be built for next year's racing season in France. The Daimler Motor Co., Ltd., of Coventry, are, it is said, building a 23 h.p. carriage, while the British Motor Co. are having a 23 h.p. vehicle built in Germany. Messrs. Edge & Jarrott, it is also announced, have 20 h.p. Napier vehicles on hand, while Mr. Wridgway is having a special 20 h.p. Pennington built.

PUBLIC MOTOR SERVICES IN RUSSIA.

Some time ago there was dispatched from Paris to Tiflis, Caucasia, a 12 h.p. Panhard omnibus, purchased by a Mr. Kochariantz, whose idea was to institute a public service with the vehicle between Choucha and Khan-Bagin. Upon the arrival of the vehicle Mr. Kochariantz was compelled to apply to the Governor of Tiflis for permission to commence the service, and thereupon a special commission was appointed to test and report as to the practicability of the vehicle. The result of the commission's examination having proved thoroughly satisfactory, the required permission has been accorded and the omnibus will shortly commence operations.

It is reported that the postal authorities in Ceylon intend ordering a motor van for the conveyance of mails between Matara and Tangalla, and Tangalla and Hambantola. The Ceylon Observer, which makes this announcement, considers it, however, to be very doubtful whether the vehicle could run satisfactorily on this line of road, which is very uneven and hilly, especially after leaving Tangalla.

At a meeting of the Chelsea Vestry last week it was stated that our tenders had been received for motor vans and that the prices quoted were £475, £490, £650, and £700 each. The surveyor was instructed to examine the various specifications and to report at the next meeting.

THE TARE WEIGHT OF HEAVY MOTOR VEHICLES.

An important conference was held at the Automobile Club of Great Britain on the 15th inst. to discuss the advisability of attempting to secure the alteration of the Light Locomotives Act so far as the tare limit is concerned. The record of a meeting of the Liverpool Branch which had been held on the 6th inst. to discuss this matter was read. It was decided to take immediate steps in the matter, but the club deem it desirable not to make known, at present, what action is proposed.

MOTOR HAULAGE ON COMMON ROADS.

This was the title of a paper read at a meeting of the graduates of the Institute of Mechanical Engineers in London last week by Alfred Marsden. The paper dealt in a comprehensive manner with the subject. The author commenced by describing the steam generator, and in discussing the merits of the three common types of generator in use he said that a combination of the water tube and the fire tube types would prove the best. The

discussion was opened by Mr. Sennett, who described a method of mounting the front axle on a horizontal trunnion, which allowed it to conform to any irregularities in the road. He also thought that the difficulties of driving over newly metaled roads, which were enlarged on by the author, were easily met by altering the gearing of the engine. Mr. Philipson, of Newcastle, said a few words from the coach builder's point of view.

NEW STEAM WAGON.

T. Toward & Co., St. Lawrence Iron Works, Newcastle-on-Tyne, have just completed a heavy steam wagon intended for conveying ore from a mine in Yorkshire. It is mounted on a strong steel frame with horn plates (locomotive style). This, in turn, is, in the case of the hind end, suspended by spiral springs on axle boxes and a steel shaft, on which the steel road-driving wheels are mounted; the fore end is supported on a fore carriage, with laminated springs, and turn plate, on a steel shaft, and steel front wheels with special auxiliary iron tires, the steering being worked by a hand wheel, worm wheel and chains on the traction engine principle. There is a cab or shelter over the driver, and the propelling machinery consists of a pair of compound reversing horizontal engines capable of developing 25 i.h.p. placed directly below the under frame and geared with two speeds (8 and 4 miles per hour), and differential gear to an intermediate shaft, which in its turn is geared direct with pinions on to an internal spur wheel on each driving wheel and entirely cased in. This dispenses with the usual chains and sprocket wheels. Steam is supplied at 200 lbs. per square inch by one of the firm's high pressure water tube boilers, placed right in front of the driver, as are the manipulating levers and steering gear. The exhaust steam passes through a filter tank, and then exhausts into the chimney, there being, it is claimed, no visible steam while running. The wagon, having been loaded with 3½ tons of material, was subjected to a trial a few days ago, when steep banks were surmounted with the greatest ease, and the mechanical tipping gear was also tested with satisfactory results.

AUTOMOBILES FOR MUNICIPAL WORK.

I have frequently referred to the increasing attention which is being devoted to motor vehicles by municipal authorities in various parts of Great Britain. This week I am able to announce that the City of London Corporation, falling into line with other local bodies in the metropolitan district, has decided to give automobiles a trial, and has intrusted Mr. Carl Oppermann, of Clerkenwell, with the construction of two motor dust carts, to be propelled by electricity.

The Spalding Rural District Council have unanimously adopted a resolution, to be forwarded to the Local Government Board, asking that the maximum speed allowed to motor carriages should be 10 miles an hour instead of 12, and that when rounding a curve it should be reduced to 6; also that a motor vehicle should give notice of its approach by a continuous bell.

The Hedworth Barium Co., of Newcastle and Jarrow, are about to run a motor wagon between their Cow Green Barium Mines and Middleton-in-Teesdale Station for the transport of barium.

Quite a number of public motor services are about to be started in the Italian Province of Puglia, while it is also stated that a foreign company has applied to the Spanish Government for a concession to establish in that country services of motor vehicles between districts not provided with railways.

It is reported that as a result of the recent tests the German military authorities have ordered five large motor vehicles from the Daimler Motoren Gesellschaft, of Cannstatt.

AN AMBITIOUS PROGRAMME.

A meeting of members of the standing committee of the Automobile Club and of representatives of firms who intend to take part in the projected 1,000-mile trial was held at the club on the 20th inst. The matter of route was first discussed, but it will not be finally settled until the secretary has been over the roads and visited the cities and towns concerned. All the representatives were in favor of an exhibition at Manchester. A vote was taken on the question of whether there should be exhibitions at both Liverpool and Manchester. Result: Twelve votes in favor of Manchester only, against one vote in favor of Liverpool also. The route will be through Liverpool if possible. In order to further shorten the duration of the tour, it was decided to hold an exhibition at Edinburgh, but not at Glasgow, and that the route should be from Carlisle to Edinburgh direct. If the local press are well disposed, and proper arrangements can be made, there will be exhibitions at Bristol, Birmingham, Manchester, Leeds, Edinburgh, Newcastle-on-Tyne and Sheffield.

NEW MOTOR VEHICLES AT THE LONDON CYCLE EXHIBITIONS.

Two different cycle shows—the Stanley, at the Agricultural Hall, and the National, at the Crystal Palace—are this week being held in London, and at both quite a large number of automobiles are on view. Many of the cars displayed are of a familiar type. While all the larger cycle making concerns are now making motor tricycles and quadricycles, the majority using the De Dion motor, I confine my remarks entirely to the vehicles which have not before been seen by the public.

THE STANLEY SHOW.

THE CENTURY TRICYCLE.

A novel two-seated motor tricycle is shown by the Century Engineering & Motor Co., Ltd., of Altrincham, Cheshire. The frame is of tubular construction; the motor is of the "Sphinx" type, of 2¼ h.p., and located underneath and in front of the rear rider. It is provided with electric ignition, and a Longuemare carbureter. The engine drives, by means of a Renold "silent" chain, a countershaft, from which the power is transmitted to the rear axle by two chains. Two speeds are provided, while the motor can be instantly disconnected from the transmission mechanism. The steering is controlled by means of a lever at the right of the driver. The steering wheels are so arranged that they incline at varying angles according to the circumference of the radius of the turn. The steering by this means is, it is claimed, rendered so safe and sure that it is possible to negotiate right angle turns at top speed with safety. A special device is provided to start the motor, while ample brake power is provided. The riders are seated tandem fashion, the front seat, which is comfortably upholstered, being suspended upon C springs and detachable

at will. The wheels are of the cycle type, 28 in. diameter, and fitted with pneumatic tires. Reservoirs are provided to contain a quantity of oil sufficient for 300 miles or more, and are so disposed that they are concealed from view. An average speed of 25 miles per hour can, it is claimed, be easily maintained on a whole day's journey over give-and-take roads. A novel feature is the provision of a pipe by means of which the exhaust can be carried at will into the foot plate of the front seat, which is double cased, so furnishing a comfortable foot warmer for use in cold weather.

A very neat two-seated voiturette is shown by Les Etablissements Pieper, of Liège, Belgium. The motor—a single-cylinder vertical one of 3 h.p.—is located in a "bonnet" at the front of the car. It is fitted with radial ribs to the cylinder for cooling purposes and electric ignition. Two speeds are provided, the power being transmitted by a single belt working on fast and loose pulleys on a countershaft at the rear. The pulleys are of equal diameter, the variation in speed being obtained by different sized spur wheels connected with the pulleys, which mesh with corresponding spur wheels on the rear axle. The wheels are of the cycle type, with pneumatic tires; ample brake power is provided, while the steering is controlled by a hand wheel. The weight is 500 lbs.

THE OPPERMANN ELECTRICS.

Electric vehicles are the specialty of Carl Oppermann, of Wynyatt St., Clerkenwell, who lately devised and adopted a new direct driving gear dispensing with the use of chain, and is showing a complete under carriage with 3 h.p. motor fitted with the new gear. The new frame (which is constructed of steel tubing) and gear is quite self-contained, and is arranged to suit a large number of different types of carriage bodies, and can be fitted up with very little labor. It is made to drive by either the front or rear axle, although the latter is preferred as being most convenient. In the new gear the motor is so arranged that instead of its shaft being parallel to the axle it is at right angles thereto. The motor shaft terminates in a worm, which gears with a worm wheel centrally placed on the axle, the gear being entirely inclosed and working in an oil bath. Mr. Oppermann has lately completed an electric dog cart, with a frame and driving gear of the type above referred to, for Mr. Dyson Perrins, of Ardcross Castle, N. B. It is fitted with a battery of 40 accumulators weighing 1,150 lbs. and having a capacity of 150 ampere-hours. The wheels are built on the tangent principle, with butt-ended spokes and steel hubs fitted with roller bearings. Solid rubber tires 2 in. wide are used, and the rear axle is fitted with a differential gear and runs on roller bearings. Steering is controlled by a bar acting on the front wheels. Band brakes are fitted to the rear wheels, operated by a foot lever. An electric brake, actuated by the controller, is also provided. The controller is arranged to give three speeds forward, corresponding to 4, 8 and 12 miles per hour, and one speed backward, all of these results being attained by means of one lever. The carriage was recently subjected to an exhaustive trial. With four passengers it weighed complete 2,500 lbs., a distance of 45 miles on one charge of the accumulators being successfully covered. Mr. Oppermann states that he is about to bring out a new type of accumulator much lighter than usual. A battery of 40 accumulators will only weigh 800 lbs., while the capacity claimed is 150 ampere-hours.

A NEW STORAGE CELL.

A new accumulator for electric vehicles is the principal exhibit of the Leecoll Electric Battery Co., Ltd., of 14 Devonshire Square, E. C. It is described as being made on an entirely new principle, neither plates of lead nor free sulphuric acid being used. The electrolyte consists of a neutral solution of metallic salts, and in charging the battery these salts are transformed into a metallic coating, which is deposited on a negative consisting of a cylinder of metal gauze after the manner of electroplating. The positive plate is incased in a porous tube, and is surrounded by the negative cylinder. The Leecoll battery is claimed to give a higher e.m.f. than a lead cell—i. e., 2.5 volts instead of only 2 volts. Owing to this high e.m.f. 32 of these cells will, it is stated, give the same voltage as 40 cells of the ordinary type. The traction type cells weigh 15 lbs. each and have a capacity of 90 ampere-hours.

A new Cannstatt-Daimler carriage is found on the stand of the Motor Carriage Supply Co., Ltd., Donnington House, Norfolk St., Strand, W. C. It is a victoria, to seat four or five persons, and is noticeable on account of its long wheel base. It is fitted with a 5½ h.p. Daimler motor in front, with a special water cooling arrangement and Simms-Bosch magneto-electric ignition. Four forward speeds and reverse motions are fitted, controlled by one lever. The steering gear is mounted on ball bearings, while the tires are of solid rubber. The carriage is fitted with a hood and can be quickly converted into a closed carriage.

THE HUMBER STAND.

Humber & Co., Ltd., Coventry, have no less than three new types of automobiles on view. One of the neatest in the exhibition is the "Humber" two-seated phaeton. The engine is of the horizontal type, of 3 h.p.; it is fitted with electric ignition and radial disks for cooling purposes, the location of the engine, with the combustion chamber to the front, in the fore part of the frame enabling air to have free access to the cylinder. Three speeds are provided, the power of the motor being transmitted by belts to a countershaft at the rear, and from the latter to the rear road axle by spur gearing. The wheels are of the cycle type, fitted with pneumatic tires, while the steering is controlled by a hand wheel acting on the front wheels. The carriage measures 7 ft. 4 in. by 4 ft., and weighs 500 lbs. It can attain any desired speed up to a maximum of 20 miles per hour.

The Humber four-seated carriage has a motor of the single-cylinder horizontal type of 8 h.p. It is located under the center of the car and is fitted with electric ignition and a water jacket to the cylinder, a circulating pump and cooling coil being also provided. The carriage is furnished with three speeds and a reverse, the power of the motor being transmitted by belts to a countershaft at the rear and from the latter to the rear axle by spur gearing. The engine and transmission mechanism are mounted on their own under frame, which is provided with special springs, while the "body" is independent and is carried by carriage springs on the axles. By this means vibration is claimed to be reduced to a minimum. A maximum speed of 19 miles per hour is provided for, while ample brake power is available, there being a band brake on the rear axle actuated by a foot pedal and tire brakes controlled by a hand wheel at the side by the driver or by foot pedals by the rear passengers. The carriage is furnished with wheel steering and pneumatic tires, and weighs complete 1,700 lbs.

HUMBER M. D. QUAD SOCIABLE.

The Humber M.D. Sociable Quad. Motor is a light two-seated carriage weighing complete only 350 lbs. The motive power is supplied by a 2¼ h.p. De Dion motor, located in a perforated metal case in the front of the carriage in such a position that the air has free access to the cylinder and combustion chamber. The ignition is electric, while two speeds are provided, the variable speed gear wheels being always in mesh, but only in operation when the low gear is thrown in. The motor transmits its power by spur wheels to the front axle, steering being effected by a hand wheel mounted on a standard at the right hand side of the carriage and acting on the rear wheels. A novel device is provided to start the motor from the driver's seat. This is effected by raising the steering hand wheels several inches in the standard. This disengages the hand wheel from the steering gear, and by giving it a few turns the engine is quickly started. The variable speed gear is controlled by a foot pedal. Ample brake power is provided, while the "body" is comfortably sprung on C springs. The carriage, which measures 6 ft. 3 in. by 2 ft. 10½ in., can, it is claimed, attain a speed of 25 miles per hour.

THE NATIONAL SHOW.

ALLDAYS & ONION'S.

A new firm to the automobile world is the Alldays & Onion's Pneumatic Engineering Co., Ltd., of Great Western Works, Birmingham, who are showing a four-seated petroleum carriage of novel construction. The motor and mechanism is all mounted on a stand and frame to which the "body" is bolted. The latter is very roomy, giving plenty of leg room and also ample accommodation for luggage, rendering it useful for touring purposes. The motor is of the horizontal type, of 7 h.p. It has two cylinders arranged in such a way that the piston rods actuate a central crank shaft. The cylinders are fitted with water jackets, while the ignition—electric—is of a special kind, both the secondary and primary currents being connected up to the sparking plug so as to insure a certain spark. The carbureter is of the spray type. The engine is located transversely at the rear and actuates through the medium of a friction clutch, a longitudinal shaft extending to the front end of the vehicle. The latter carries the variable speed gear—three speeds and one reverse motion. It consists of a series of spur wheels, any one of which may be brought into gear by a single handle with corresponding spur wheels on a small parallel shaft. In examining the variable gear we noted that one of the pinions—that giving the low gear—is also employed in the reverse motion; by moving it further along the shaft it disengages from its corresponding low gear wheel and comes into mesh with the reverse motion wheels. The long central shaft terminates under the fore part of the carriage in a bevel wheel, which gears with a corresponding wheel on an intermediary shaft. The latter carries a belt pulley and is connected by a long crossed belt to a second intermediary shaft located above the rear differential axle, the connection with the latter being effected by spur gearing, the use of chains being in this way avoided. The wheels, which are mounted on roller bearings, are of the cycle type, with solid rubber tires, while the steering wheel is mounted on the standard at the right of the driver. Two foot pedals are provided, by means of one of which the clutch can be instantly thrown out, while the other controls a band brake on the countershaft. Band brakes actuated by a hand lever acting on the rear axle are also provided. The water tank has a capacity of 10 gals., the circulation being maintained by a small pump driven by friction off the fly wheel. A water cooling coil is provided in the fore part of the frame. The weight of the vehicle is given as 1,500 lbs., and a useful feature of it is the accessibility of all the working parts for inspection.

THE NAPIER MOTOR CARRIAGE.

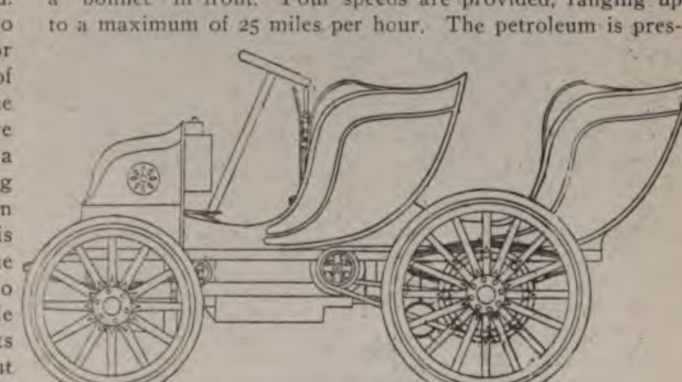
I send you an outline view of one of the new carriages at present in course of construction by the Motor Vehicle Co., licensees of the Napier Motor, already illustrated in your columns. The motor is located in front on the Panhard system.

THE ESCULAPE.

A neat two-seated voiturette of French construction is shown by the Automobile Union, of 39 Avenue des Champs Elysées, Paris. It is known as the "Esculape," and is propelled by a 2¼ h.p. De Dion motor. A feature of the latter is, however, that in addition to the radial disks on the cylinder the explosion chamber is furnished with a water jacket. The carriage has a two-speed gear, cycle type wheels with pneumatic tires and weighs only about 400 lbs.

THE DAIMLER EXHIBIT.

The largest exhibit of motor vehicles is undoubtedly that of the Daimler Motor Co., Ltd., and prominent among the vehicles on view is a new Parisian four-seated racing phaeton. Built on the lines of the modern French racing carriages, this vehicle has a body of aluminum, this metal being also used wherever possible in the construction to bring down the weight. The frame is rather lower than usual. The motor is of the standard Daimler type, of 6 h.p., and is located under a "bonnet" in front. Four speeds are provided, ranging up to a maximum of 25 miles per hour. The petroleum is pres-



GASOLINE CARRIAGE OF THE MOTOR VEHICLE CO.

ALLDAYS & ONION'S GASOLINE CARRIAGE.

sure fed to the motor, while the carriage is provided with a special accelerator acting on the engine governor and manoeuvred by a foot pedal. Steering is controlled by a sloping hand wheel, while the speed control levers are arranged on the outside of the body at the right hand side of the driver. Special attention has been paid to the bearings, which are extra long, as also to the suspension of the car. The band brakes act on a drum forming part of the rear wheel sprockets. The wheels are of light but strong construction and are shod with heavy pneumatic tires. The weight is given as 1,800 lbs. Another carriage exhibited was the special Parisian phaeton to seat five, three on the front seat and two at the rear, the latter sitting cornerwise. This carriage is fitted with the standard 6 h.p. motor, and has four speeds, the maximum being 25 miles an hour. It is fitted with pneumatic tires, and in other respects resembles the Parisian racing carriage above described, being provided with wheel steering, pressure oil feed, foot pedal accelerator, wire band brakes on sprocket wheels, etc. The largest vehicle on the stand was a nine-seated omnibus of the type the company is now supplying for public services in various parts of the country. It is provided with detachable top, with glass sides, the driver being also protected from the weather. It has a 6 h.p. motor, four speeds (14 miles per hour maximum), lever steering, and solid rubber tires. A new pattern, so far as the body is concerned, of the "Critchley" carriage also attracted attention. The carriage, which is adapted for two persons, has a 4 h.p. motor, the transmission being effected by belts. Three forward speeds—5, 10 and 20 miles per hour—are provided, as also a reverse motion. Steering is controlled by a sloping hand wheel, the belt control lever being mounted on a separate vertical standard. Band brakes are provided, as also a special shoe brake acting on the rear wheel pneumatic tires. The motor is pressure fed, and is fitted with an improved type of automatic lubricator, the "Drake."

THE LILLIPUT.

The "P. T. S." Motor Co., of 1 Chiswell St., Finsbury, E. C., are showing a neat two-seated voiturette of German construction. It is constructed under Heinle-Wegelin patents, and has a two-cylinder motor of 3½ h.p., partially air and partially water cooled. It is fixed under the seat and started by means of a lever and a ratchet quadrant from the seat. The ignition is electric, the spark being obtained from an electro-magnet. Two brakes are available—a band brake on the driving shaft and shoe brakes operating on the rear wheels, which are 32 in. diameter. The carriage measures over all 6 ft. by 3 ft. 6 in. by 4 ft., and weighs 600 lbs. Three speeds are provided, the maximum being 25 miles per hour. The carriage, which has been named the "Lilliput," is provided with a cooling coil in front.

THE "INTERNATIONAL" VEHICLES.

The International Motor Car Co., of High Road, Kilburn, N. W., is another concern making a very large display. In addition to a light delivery van and about six of their well-known International cars on Benz lines to seat two or three persons, the company showed several frames fitted with motors and transmission gear complete, which comprise several special features. The "Vibrationless" carriage is shown minus the body in order that the motor may be closely inspected. This is a two-cylinder one of 9 h.p., the cylinders being so arranged that the piston rods actuate a central crank shaft. The cylinders are water jacketed, special attention having been paid to the question of preventing leakage of water into the cylinder. The ignition is electric, the explosion taking place alternately in the cylinders. The speed of the motor is 1,100 revolutions per minute, the cranks working in an oil-containing case. No asbestos is used in the ignition plugs, metallic joints only being employed. The vehicle, which can be fitted with a body to accommodate either two, four or six persons, is provided with three forward speeds, a hill climbing gear and a reverse motion. A new departure is the method adopted to warm the oil in the carbureter, this being effected by a steam pipe from the water condenser. Wheel steering is provided, while all the belt control levers are mounted on the steering standard. The wheels are of the cycle type, with strong axles working on ½-in. balls, the tires being of solid rubber. A band brake is fitted, acting not on the rear axle, as usual, but on a drum on the countershaft.

A DOCTOR'S CARRIAGE.

Dennis Bros., of High St., Guildford, are showing one carriage and several cycles of their own construction. The "Speed King" light doctor's carriage—as it is called—exhibited is not quite in a completed condition, but it is to be fitted with a 3 h.p. air cooled De Dion motor located in the rear part of the vehicle. Three speed—4, 10 and 20 miles per hour—

are provided, the transmission being effected to the rear axle by spur gearing. The frame is of tubular construction, the body being adapted to accommodate two persons. Steering is effected by a lever at the right of the driver; the wheels are of the cycle type, shod with pneumatic tires.

A FAN-COOLED MOTOR.

An attractive looking, light, four-seated carriage of new design is exhibited by the Delecroix Motor Syndicate, Ltd., of 15 Angel Court, Throgmorton St., London, E. C. It is fitted with a single-cylinder vertical motor of 3½ h.p. located under a "bonnet" in the fore part of the frame. Great attention has been devoted to the cylinder cooling arrangements, there being radial disks and a rotating fan, and also a special device by means of which cool air is claimed to be introduced into the inside of the cylinder and the hot air ejected. The ignition is electric, while three forward speeds, as also reverse motion, are provided. The longitudinal shaft, which carries the variable speed gear, terminates in a bevel wheel meshing with a corresponding wheel on the countershaft, from which the power is transmitted to the rear axle by a single chain. A friction cluth is provided by means of which the motor can be instantly cut out from the transmission, the hand lever controlling the clutch also being connected up to the band brake on the differential gear. A foot pedal actuating band brakes on the rear axle is also fitted. The carriage is suspended by easy springs on the frame. The steering is by means of a bar, while the wheels are of the cycle type with pneumatic tires. It will, it is claimed, climb 18 per cent. gradients, and weighs complete 480 lbs.

THE "WEARWELL."

The Wearwell Cycle Co., Ltd., Poutney St., Wolverhampton, show a new two-seated car, the frame of which is of tubular construction, the motors, two in number, being arranged in the center under the seats. The engines are of the De Dion type, and together indicate 4½ h.p. They are fitted with radial disks for cooling purposes and electric ignition. Three speeds are provided, the motors driving by spur gearing on to a countershaft, from which to the rear axle the power is transmitted to the rear axle by a single central chain. Steering is controlled by a hand wheel on a vertical standard, a useful feature being that the height of the hand wheel from the floor of the carriage can be adjusted. A foot pedal controls a band brake on the rear axle; the wheels are of the suspension type with pneumatic tires. The weight of the carriage, which was shown in an incomplete condition, is given at 500 lbs.

TWO-SEATED TRICYCLE.

A novel two-seated tricycle is to be found at the stand of the New Courier Cycle Co., Alexandra St., Wolverhampton. The frame is of rectangular tubular construction; the motor—a 2¼-h.p. De Dion—which is located about the center, drives, by spur wheels, a small countershaft, which is connected to the rear axle by chain gearing. A feature of the machine is that no pedals are provided; at the rear hub a special band brake free wheel device is provided. This is operated by the left hand foot rest, which is also connected with a hand lever. By means of this the engine can be instantly put out of gear with single rear wheel, thus enabling hills to be "coasted." To start the motor, the band brake of the drum is applied, the electric current switched on, and the machine pushed a short distance. Immediately the motor is in operation the band brake is released, thus allowing the engine to run free until the driver is ready to start. After mounting, the left pedal is pressed down, applying the band brake device at the rear and completing the connection between the motor and the rear wheel. A second band brake is provided on the opposite side of the rear hub. Steering is controlled by a bar with vertical grips,

THE NEW ALLARD CARRIAGE.

on the top of the right one of which the contact breaker is mounted in such a way that it can be moved by the thumb, thus affording a rigid grip in place of the one usually employed on tricycles. The machine is purposely only speeded up to about 15 miles per hour, but the makers claim that it will maintain this speed even up ordinary hills. The weight of the machine is stated to be a little under 200 lbs.

A KEROSENE CARRIAGE.

Roots & Venables, of 100 Westminster Bridge Road, S. E., have on view the only kerosene motor carriage in the exhibition. This is a neat two-seated vehicle, fitted with a 3 h.p. horizontal motor. Two speeds are provided—3 and 12 miles per hour—the motor being chain geared to a countershaft, from which to the rear axle the power is again transmitted by chains. A novel feature is the water cooler, which consists of a long

THE "SWISS MOUNTAINEER."

spiral of copper tubing, inside which rotates the fly wheel of the engine. The carriage weighs, complete, about 600 lbs. and measures 7 ft. 4 in. by 4 ft. 11 in. It is fitted with cycle type wheels and solid rubber tires.

Frank P. Wellington, 36 St. George's Square, Regent's Park, N. W., exhibits a neat two-seated voiturette, constructed by the Phébus Co. in Paris and known as the "Automobilette." This is a four-wheel carriage, with cycle type wheels shod with pneumatic tires. The motor—a 2¼ h.p. Aster—is geared to the rear axle through the medium of a two-speed gear. The frame is of tubular construction, the body being well suspended thereon by C springs, while the steering is controlled by a sloping hand wheel. Ample brake power is provided, the weight of the vehicle being about 350 lbs.

THE "SWISS MOUNTAINEER."

The "Swiss Mountaineer" carriage exhibited by Hupfeld & Co., of 7 Wilmington Ave. Leadenhall St., London, E. C., is built by the Patent Motor-Wagenfabrik "Rapid," of Zurich. It has only three wheels, and is adapted for two persons. The frame is of tubular construction. The engine is of the horizontal type, with water jacket and electric ignition. At a speed of 800 revolutions it develops 4 h.p. Two speeds are provided, the power being transmitted by a single belt working on fast and loose pulleys. The latter are of equal size; each are, however, mounted on distinct sleeves provided with pinions gearing with corresponding pinions on the axle of the rear wheel, the power being transmitted through that pair of pinions connected with the pulley, on to which the belt is shipped. When the belt is on the central pulley the motor is entirely disconnected from the rear wheel. The carriage is mounted on easy springs, cycle type wheels and pneumatic tires being also adopted. The water tank is located over the rear wheel, it being also made to serve as a mud guard. The belt and variable speed gear is inclosed in a dust proof case, which can be quickly removed for inspection purposes. The carriage measures 6 ft. by 3 ft. 8 in., and weighs about 500 lbs. It can, it is claimed, attain a speed of 25 miles per hour.

THE "STAR CARRIAGE."

Since the "Star" motor carriage of the Star Motor Co., Wolverhampton, was first brought to the notice of the public it has been considerably improved, both as regards construction and design, as will be seen from an examination of the two vehicles on view. One is finished in varnished light birch wood, while the other is painted in olive green and black, and yellow lines, upholstering to match. The carriages, although really only intended for two persons, are provided with an additional seat in front for one or two persons. They are fitted with a 3½ h.p. single-cylinder horizontal motor, two speeds, by belts, and are claimed to be capable of mounting all ordinary gradients with a full load. One of the novel features is the employment of a new form of spray type carbureter, the claim for which is its regularity of working, obviating the employment of a mixing valve. The new carbureter is so arranged that it can be quickly detached if necessary, and its location renders the sparking plug more accessible than usual. A new device has also been adopted for the adjustment of the chains.

THE NEW ALLARD VEHICLES.

Allard & Co., of Earlsdon Works, Coventry, exhibit a new carriage on Benz lines—the "Allard Express," arranged to carry four persons. The engine is of the horizontal single cylinder type, of 4½ h.p., with water jacket and electric ignition. It is located in the rear portion of the car, and transmits its power by belts to a countershaft, the latter being conected by chain gearing to the rear axle. Two speeds—8 and 20 miles per hour—are provided. The wheels are of the cycle type, with pneumatic tires, while the steering is controlled by a bar.

Two band brakes are provided, as also two shoe brakes acting on the rear tires. The weight of the carriage is between 1,000 and 1,200 lbs.

Another new carriage is the "Allard Rapid." This is adapted to carry two persons, the "body" being mounted by strong springs on a tubular frame. The motor, a single-cylinder vertical one of 3 h.p., is fitted with radial disks around the cylinder and a water jacketed explosion chamber for cooling, and electric ignition. It is located at the front part of the frame, and is connected by spur gearing to a countershaft, from which the power is transmitted by belts working on fast and loose pulleys direct to the rear axle. Two speeds are provided, the maximum being 20 miles per hour on good level roads. The carriage is fitted with cycle type wheels and pneumatic tires and weighs about 500 lbs. A noticeable feature is that the steering bar and belt control gear are mounted on vertical standards fixed just outside the footboard at the right of the driver.

THE "LOCOMOBILE" ON VIEW.

Ever since the appearance of the Whitney steam carriage in July last, considerable interest has been centered on the light steam vehicles hailing from America, with the result that the Stanley is exhibited by the "Locomobile" Co. of America, who have now established themselves in this country at 52 Sussex Place, South Kensington, S. W., and has this week been the center of a throng of inquiring visitors.

THE BEESTON CARRIAGES.

In addition to their motor tricycles and quadricycles, the Beeston Motor Co., Ltd., Coventry, exhibit a light two-seated carriage of neat and attractive appearance. It is provided with a 3½ h.p. air-cooled vertical motor of their own construction, located at the rear of the car, and is fitted with electric ignition. Two speeds—the maximum being 16 to 17 miles per hour—are provided, the power of the motor being transmitted to the rear axle by spur gearing. A friction clutch is provided by means of which the motor can be instantly cut out from the transmission. Steering is controlled by a hand wheel on a vertical standard, the latter also carrying a second wheel by means of which the variable speed gear is manœuvred. The frame is built up of channel steel, to which the body is bolted. The wheels are of the cycle type, with pneumatic tires. Two indepndent band brakes are used, while the petroleum tank is of a capacity sufficient for a run of about 65 miles. The weight of the carriage is about 450 lbs.

COMMUNICATIONS.

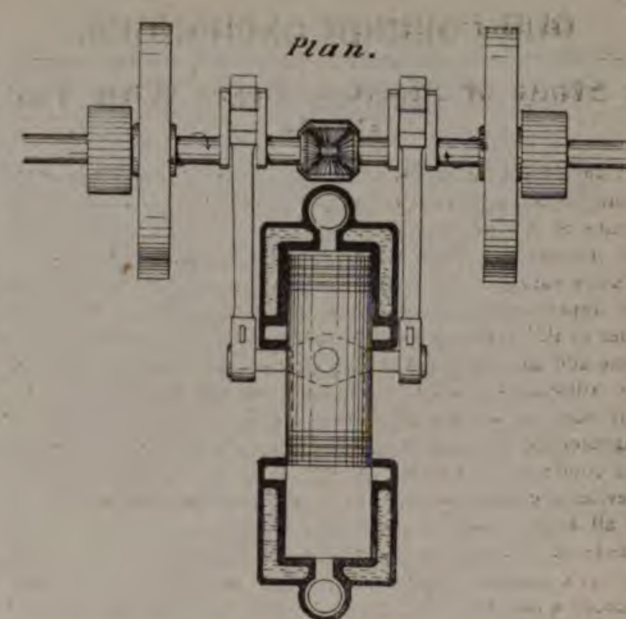
A Balanced Motor of Practical Design.

Brooklyn, N. Y., Dec. 6.

Editor Horseless Age:

About a year ago I designed this motor for a vehicle. According to E. J. Stoddard's demonstrations in your valuable paper it is perfectly balanced, for it not only satisfies all the "ifs" he counts on page 16 of No. 5, Vol. 5, but even surpasses some of them.

The motor is of the two-cycle class, with one double-ended cylinder. It therefore does the work of four four-cycle cylinders of the same dimensions, or, in other words, acts like an



ordinary single-cylinder high pressure steam engine. The double-ended cylinder has the same great advantage over the single-ended as that of the steam engine, viz,, the acting pressure of explosions on one side of the long piston finds toward the end of its stroke a substantial cushion in the compress of from 75 to 90 lbs. per square inch on the other side of the piston, thus relieving the journals of so much end pressure, which allows considerable lightening of the whole frame and helps to balance. Still being open, the cylinder retains the advantage of the open-ended one—i. e., saving of cooling water through radiation of the inner parts (piston, etc.) exposed to the atmosphere. The entire absence of the troublesome stuffing box in other double-ended or tandem engines cannot be overlooked.

The two connecting rods, of equal weight and balanced in the two equal fly wheels, work in opposite directions, caused by the compensating gears placed in the center line of the two shafts and the cylinder. This feature answers for reversing in a very simple manner. The valve gear is so arranged that at no time can the new mixture and the exhaust gases come in contact, which prohibits both the waste of mixture through the exhaust ports, and the ignition before the end of the stroke (nachbrennen), the great drawback in most two-cycle gas engines. There is no exhaust valve and no moving parts for the electric or tube ignition.

This arrangement can be made to work as four-cycle also, but the two-cycle is preferable.

With the necessary alteration in the valve gear this design of motor is adaptable for any fluid pressure, such as steam, compressed air, etc.

W. C. WACHHOLTZ.

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of THE HORSELESS AGE, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

OUR FOREIGN EXCHANGES.

A Study of Steering Gears With Two Pivots.

Considerable attention has already been given in these columns to the problems incidental to steering automobiles by means of the divided axle, and we are pleased to note a similar interest manifested in our foreign exchanges. A comprehensive survey of the subject from the pen of M. Bourlet,, D. Sc., appears serially in La Locomotion Automobile. We shall refer to this series at some length when the articles are complete and append at this time a compilation from the pages of the Automotor Journal, Le Genie Civil and Engineering. In this study of divided axle steerings, as in other branches of engineering, the best result must be a compromise between the conditions demanded by theory on the one hand and the inevitable circumstances contingent upon mechanical devices of all kinds. Take the example which is mentioned in the article—a steering gear with some eighteen links. It would be but a very short period before the many pivots and bearings on a machine exposed to the abrading influences of road service would have worn to such a degree as to seriously impair whatever mathematical accuracy the original combination might have possessed. To properly impress these theories upon mechanism in a concrete and useful form is the duty of the designer and the publication of these carefully reasoned investigations, for the critical consideration of our readers is equally incumbent upon ourselves.

In 1817 a citizen of Munich named Lankensperger invented an arrangement of turning axles, for which invention J. Akermann, of London, obtained an importing patent in 1818.

This invention had almost entirely fallen into disuse when, in 1878, it was applied to a mechanically propelled vehicle by M. Jeantaud.

When a carriage with wheels fixed to the axles in the ordinary way turns a corner some of the wheels drag sideways to some extent. It is not of very great importance in horse drawn vehicles, but is more important when the wheels are no longer pulled around, but act as steering wheels.

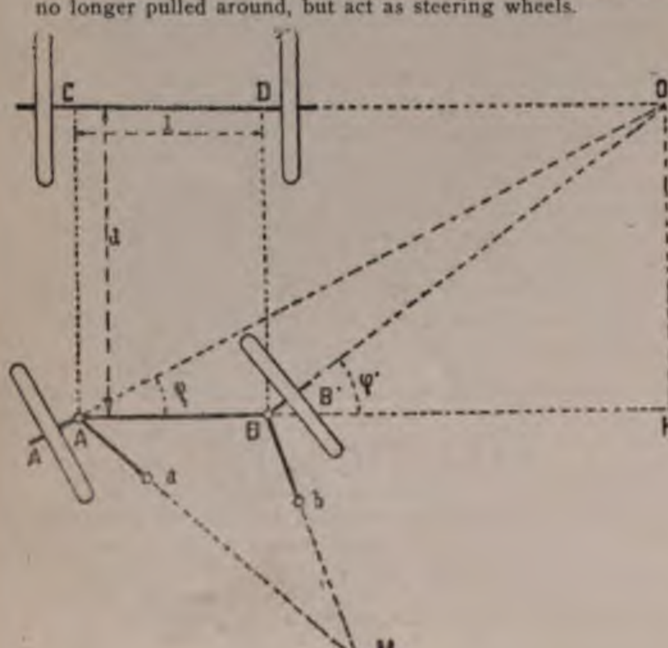


FIG. 1

A certain fundamental relation is necessary in order that the carriage may turn without any of the wheels dragging. This relation being that, at any instant, the axles of the wheels produced shall all meet in one vertical line, the instantaneous axis of rotation. If the wheels are all the same size this line becomes a point.

In Fig. 1 CD is the rear axle, AB the fore axle, the journals, AA' and BB', of the guiding wheels pivot around the vertical axes, A and B. CD being a fixed axle, it is clear that the axles of the rear wheels produced are both CD, and may be said to "meet" at any point in CD, so that, in order to fulfill the fundamental condition of turning, it is necessary that the axles AA' and BB' shall meet in CD, say at O, the vertical plane through CD in plan.

If we denote the wheel base by d, the distance apart of the vertical pivots by l, and the angles, OAH and OBH, by ϕ and ϕ' we get the following relationships:

$$\text{Cotan } \phi - \text{Cotan } \phi' = \frac{l}{d};$$

an analytical statement of the condition of smooth turning.

There is another and more convenient way of expressing this condition.

The journals AA' and BB', being furnished with two arms, Aa and Bb, so that A'Aa and B'Bb form bent levers, we have to find the locus of their meeting M, given that the locus of O is in CD.

This locus has been shown generally to be a conic section passing through A and B, except in one case, when it is a straight line parallel to AB, and at a distance from it equal to the wheel base. This is when the locus of O is on CD—our case. A proof of this will be given further on.

In drawing diagrams it is found more convenient to deal with this point than with the point O, as it is within a diagram of reasonable size for any ordinary angle of turning; for very great angles of turning, when M is "off the board," O comes within the diagram; so that one or other point can always be used.

The simplest way to make a steering gear seemed at first to be by the use of jointed links. A gear which fulfills the condition can, however, only be made by using very many links—so many that in practice the use of such a gear is impossible, 18 links being the smallest number which have been made to fulfill the condition.

It is possible, however, to get an approximation to the condition with a small number of links, especially as the turning angles of a vehicle are within limits. For other reasons than those of the steering gear, the angle of turning is limited to about 40 deg. We are not aware of more than one type of actual mechanism which fulfills the condition for all angles excepting when the fore axle is both driving and steering axle.

The simplest link mechanism is the Akermann-Jeantaud. It consists in joining the two arms Aa and Bb by a link, ab, jointed at a and b. In Lankensperger's arrangement the trapezium AabB is turned backward. M. Jeantaud formerly proposed the following plan for drawing the trapezium:

Bisect CD in O and join OA and OB.

Take points a and b on these lines and try, graphically, what positions give the best results.

Under the best conditions this empiric rule only gives good results with steering angles of up to about 30 degrees, after which its variation from the condition increases rapidly. With almost all backward-turned trapeziums the variation from the

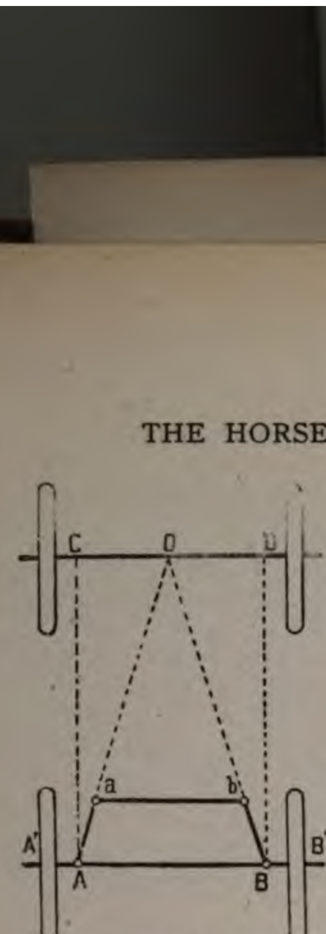


FIG. 2.

fulfilling of the condition becomes considerable almost as soon as it becomes sensible.

The trapezium AabB may be behind the steering axle, as in the Jeantaud system, or in front of it, as in the Panhard-Levassor system.

In practice a departure is made from theory, as it is found that, with these trapeziums, the best results are obtained when EF, the intercept of Aa in the angle CDE, is twice Aa (see Fig. 3), or, in the case of the forward trapezium, the intercept of Aa in the angle DDE is twice Aa (see Fig. 4). The angle of turning is limited by the positions Aa, b, B of the trapezium in Figs. 3 and 4. In the case of short, wide carriages we find that this limit does not give us a large enough turning angle.

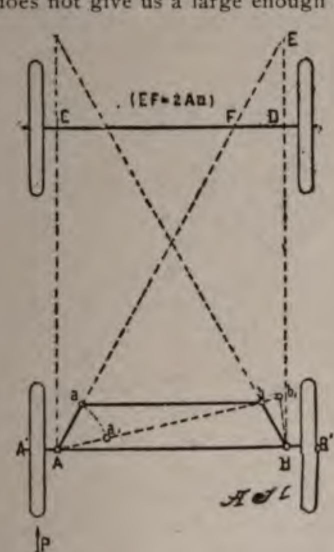
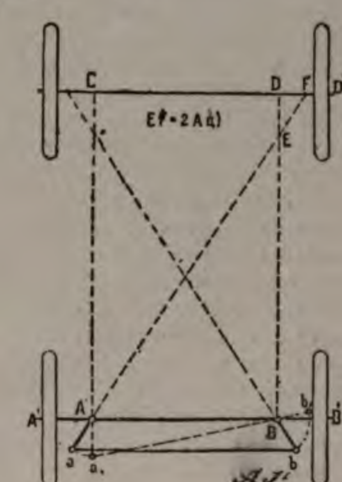


FIG. 3.—Theoretical Arrangement of Jeantaud Trapezium.

With the forward trapezium, if the wheel gauge is great in comparison with the wheel base, the drawing gives us widely diverging arms, Aa and Bb, Fig. 4, and in order to prevent their touching the spokes of the driving wheels the journals have to be lengthened. This greatly increases the bending moments at the pivots A and B. These gears, then, are only useful for long, narrow carriages, and it is impossible to modify them satisfactorily to suit short, wide ones. Of the two systems that of Panhard and Levassor, or the forward trapezium, has two advantages over the Jeantaud, or backward trapezium. In the first place, it gives larger angles of turning for the same gauge, and, in the second place, when one of the wheels (or both) meets an obstruction, the levering around the pivot at A or B gives rise to tension in ab. It is clear that under the same circumstances it is, in the other system, in compression, a considerable disadvantage. Against this we have to set the difficulty with journals in the forward system, already mentioned.



4.—Theoretical Arrangement of the Panhard and Levassor Trapizeum.

THE BOURLET AND DAVIS SYSTEMS.

M. Bourlet, in France, and Mr. Davis, in England, have each invented a mechanism strictly fulfilling the fundamental condition. These two mechanisms are strictly the same in principle.

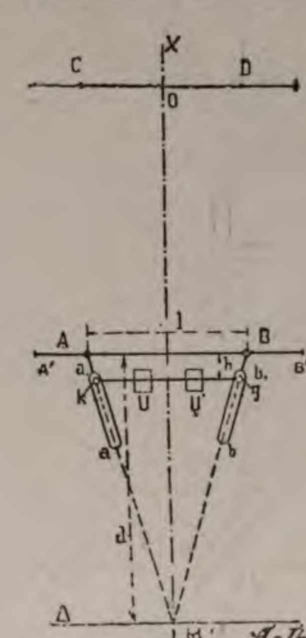


FIG. 5.—The Bourlet Steering System.

Fig. 5 shows that of M. Bourlet. The journals AA' and BB' form obtuse angles with the arms Aa and Bb, and these arms, produced, meet in M. The distance d is equal to the wheel base .

The ends of the arms Aa and Bb form slides, aa and bb. In these slides move rollers, free to move up and down the slides but fixed at the ends of the rod kg. This rod and its rollers can only move parallel to AB, being constrained by the sleeves U and U. It is always parallel to AB, and at the same distance, h, while the slides really move on the rollers. By similar triangles, as we show below:

$$\frac{d}{d-h} = \frac{AB}{gk} = \text{a constant,}$$

h is a constant; therefore d is a constant and M moves parallel to AB, satisfying the fundamental condition.

The rod gk may be moved by various devices. It is in tension when the wheels meet obstacles. No lengthening of the journals is necessary.

THE DAVIS SYSTEM.

This system, Fig. 9, differs from that of Bourlet in that, instead of rollers moving in slides at the ends of the arms, the last are plain rods sliding in sleves, which are jointed at the ends of the rod LM.

Mr. C. A. Matthey proves the correctness of Davis's gear in the following way:

For all gears in which the front axles, produced, meet on the rear axle, produced, while the helm is being put over either way, instantaneous angular velocities of the steering

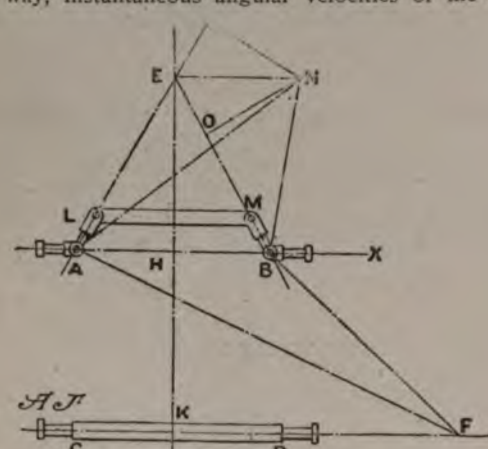


FIG. 9.—The Davis Steering System.

wheels about their vertical axes are in the inverse ratio of the squares of the lengths of the axles measured from the vertical axes to the intersection of the axles.

In Fig. 6, if the helm be moved so that the point F moves along CD, the instantaneous angular velocity of B is to that of A as AF^2 is to BF^2, or as cosec^2 XAF is to cosec^2 XBF, or as $\sin^2$ XBF is to $\sin^2$ XAF.

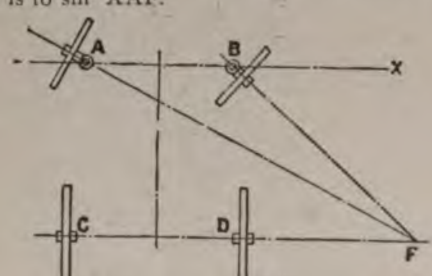


FIG. 6.

To prove this, in Fig. 7 let B be center about which BF swings, F being always in CDF. Suppose the linear velocity of F along CD to be constant.

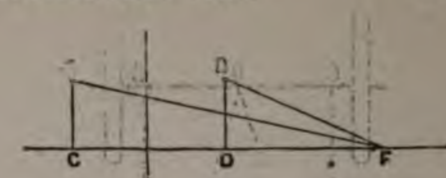


FIG. 7.

Now, the instantaneous angular velocity, i.a.v., of F about B is directly as the component of the linear velocity resolved at right angles to BF and inversely as the radius BF.

Thus, when F passes B, the i.a.v. is the linear velocity divided by BD, which expression we may call unit i.a.v.—i.e., unit linear velocity divided by unit radius.

In the same way we see the i.a.v. of F is the actual velocity along

$$\frac{\text{DF x sin BFD}}{\text{BF}}$$

So I.AV. of BF = $\frac{\sin BFD}{BF}$ for unit velocity, but

BF = cosec BFD (BD being unity) = $\frac{1}{\sin BFD}$

Therefore i.a.v. of BF = $\sin^2$ BFD.

Similarly, if A be another center at a distance from CDF of AC = BD, the i.a.v. of F about A is $\sin^2$ AFC.

Therefore, the i.a.v.'s of F about A and B respectively are in the ratio of $\sin^2$ AFC to $\sin^2$ BFC, or inversely as the squares of AF and BF.

Clearly this is also true when the velocity is not constant, as at any instant the velocity of F is the same for both.

In Davis's gear, Fig. 9, the levers AL and BM, produced, meet in E, EHK being at right angles to AB and EH = HK. LM is guided parallel to and always at the same distance from AB. E will always move in a straight line parallel to AB.

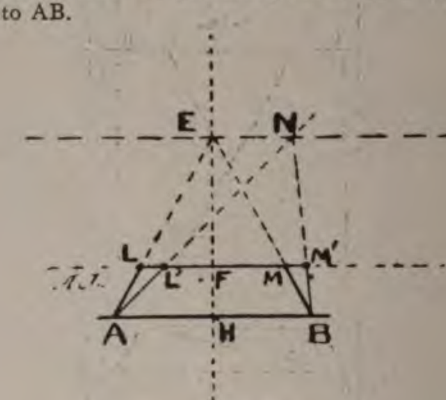


FIG. 8.

To prove this, in Fig. 8, let LM move to any position L'M'. Then, by the construction of the gear, LL'MM' is a straight line parallel to AB. Therefore

$$\frac{BM'}{BM} = \frac{BN}{BE},$$

Similarly for the points L and L'.

That is, the line LM' divides the sides of the triangle NAB in the same proportions as it divides those of the triangle EAB.

Therefore the triangle NAB is to the triangle EAB as the quadrilateral L'ABM' is to the quadrilateral LABM.

But these two quadrilaterals are easily seen to be equal.

Therefore the triangle NAB is equal to the triangle EAB on the same base.

Hence the line EN is parallel to AB for any position of N. Now, in Fig. 9, from N drop perpendiculars NO, NP, on to BE and AE, produced. Evidently the triangles NEP and NEO are equal in all respects, and NP = NO.

The axles of the front wheels, making always the same angle with their respective levers, have moved through angles XBF and XAF, equal respectively to NBE and NAE.

Be it noted that we do not know as yet that the point F lies in CD, the rear axle produced.

The i.a.v. of BN is always equal to that of BF, the two being always at the same angle, and so with AN and AF.

Then—

$$\frac{\text{I.A.V. of BF}}{\text{I.A.V. of AF}} = \frac{\text{I.A.V. of BN}}{\text{I.A.V. of AN}}$$
$$= \frac{AN^2}{BN^2} = \frac{AN^2}{NP^2} \div \frac{BN^2}{NO^2}$$
$$= \frac{\text{Cosec}^2}{\text{Cosec}^2}\ \frac{NAE}{NBE} = \frac{\text{Cosec}^2}{\text{Cosec}^2}\ \frac{XAF}{XBF}$$
$$= \frac{AF^2}{BF^2}$$

Therefore F moves in some straight line parallel to AB.

That this straight line is CD, the rear axle produced, is evident from the consideration that there is one position of the gear in which the straight line joining N and F is at right angles to AB.

Now, it is seen in the course of the above reasoning that

$$\frac{BF}{AF} = \frac{BN}{AN}$$

and in that particular position it follows that F and N must be equidistant from AB; and hence in all other position as they move parallel to AB.

Mr. J. Macfarlane Gray, M.I.N.A., etc., the well-known author of the "Theta-phi" diagram, and formerly examiner of engineers to the Board of Trade, has devoted attention to the subject of the steering of vehicles, and furnishes the following proof of the above theorem:

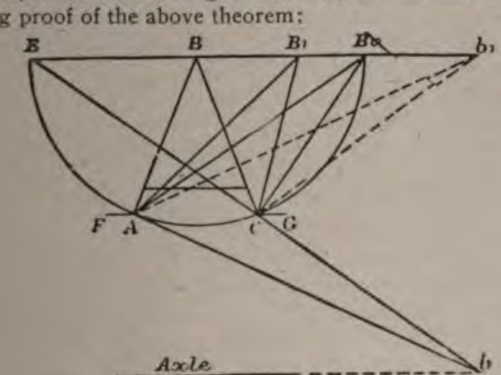


Fig. 10.—Macfarlane Gray's Investigation.

Let ABC, Fig. 10, be the steering frame in its middle position, and FG the axial line of the fore wheels at the same time. Bisect the angle BCG by the line CB_0 and make B_0CE a right angle; the semi-circle on EB_0 will pass through A and C, and it is the locus of the vertices of all triangles having their base in the line EB_0, and their vertical angle bisected by a line through B_0; if one triangle on the same with its vertex on the semi-circle has its vertical angle bisected by a line through B_0 (Euclid VI. 3. and A).

At C make any angle B_0CB_1 equal to B_0Cb_1, and join AB_1 and Ab_1. By the theorem referred to, the angle $B_1AB_0 = b_1AB_0$.

The line Ab_1 and Cb_1 are respectively the images of the actual axial lines Ab and Cb for the position of the steering vertex, B_1. The image point b_1 travels in the same straight line as B_1, and therefore the actual point of intersection b travels in a straight line parallel to the path of B_1, and at the same distance from FG, which line ought, therefore, to be the axial line of the hind wheels.

These two proofs are exactly the same for the Bourlet as for the Davis gear, there being no difference in principle. It may be interesting to refer here to a form of control which can be used with any of the mechanisms described. This is the control of M. Jeantaud, of which Fig. 11 is a diagrammatic representation of a section perpendicular to the steering spindle A, between which and the hand wheel (not shown) it forms a connection.

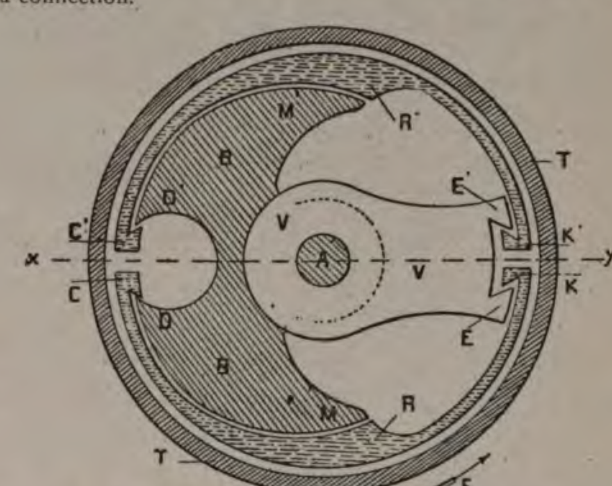


Fig. 11.—M. Jeantaud's Irreversible Control Arrangement.

The hand wheel is attached to the piece V, which is furnished with two fingers, E and E', and turns loose on the spindle A. The piece BB is keyed on to A, and is provided with two fingers, D and D'. A spring, R, covered with leather and terminated by two hooks, C and K, unites the fingers E and D; another spring, R', symmetrical to R about XY, unites the fingers E' and D' by means of the hooks C' and K'. Finally, the whole is inclosed in a drum, T, firmly attached to the fixed sockets in which the spindle A turns.

Let us suppose, firstly, that the conductor turns the hand wheel in the sense of the arrow F. The piece V will turn in the sense F and by the finger E will drag the spring R, which will engage with the piece B by the hook C and pull it by the finger D. As B is fixed on the spindle A the wheel in this way turns A.

By turning the hand wheel in the opposite sense the spring R' comes into play and connects the hand wheel and the spindle. Suppose, however, that the spindle tries to turn in the sense of F under the action of the wheels. The fixed piece B will turn in the same sense, the portion of it marked M will engage with the spring R and, owing to the taper of the part of the spring opposite M and the slope on M, the piece B will force the spring to expand. In expanding the spring, R will press against the internal wall of the fixed drum T, thus acting as an automatic brake to the gear. If A attempts to turn in the opposite direction the spring R will rub the surface of the drum in the same way. In either case the control is irreversible.

Why a Rotary?

By P. L. Tygard.

It seems to be one of the paradoxes of mechanical development that while 90 per cent. of all the power generated is utilized in rotary motion, it is practically all developed along a right line in alternate directions.

That the records for economy and efficiency have heretofore been constantly held by the reciprocating engine the writer is free to admit. Notwithstanding this, that an intelligently designed rotary engine has points of decided superiority this article is intended to demonstrate.

In order to compare the relative merits of the reciprocating and rotary principles as applied to a steam engine, let us for a moment follow the current of steam as it flows from the boiler to the engine and note as far as possible the circumstances under which it is compelled to perform work in a reciprocating engine.

On first entering the cylinder the piston is found to be momentarily at rest, and the connecting rod without angularity relative to the crank, causing the entire loss of the impact force of the steam.

As the piston begins to move and the angularity of the connecting rod increases, the force of the steam against the piston becomes increasingly effective in producing rotary motion until about one-half the stroke or one-fourth of the revolution is completed, decreasing from this point until it becomes nil at the end of the stroke or first half of the revolution, repeating in a reverse direction during the second half of the revolution.

If the engine is automatic, the flow of steam will be stopped at about one-fourth of the stroke, at which time the connecting rod will be about midway of its increasing angularity. From this time on the pressure on the piston decreases as the steam is allowed to expand; but as the efficiency of force against the piston increases with the angularity of the rod, the rotative force remains practically constant until the first half of the stroke is completed. From this point to the end of the stroke the rotative effect decreases very rapidly, owing to the loss of angularity of the rod, combined with the decrease in the pressure of the steam, due to its expansion.

It is evident that under the above circumstances only an intermittent torque can be obtained. This again is aggravated by the early limit to the number of strokes enforced by the mechanical difficulty in starting and stopping a mass rapidly, which limit is directly opposed to the high piston speed so favorable to economy in the use of steam. Again, steam on entering a reciprocating engine first impinges against a stationary mass to which it must impart motion. This motion is then transmitted to the crank pin through the connecting rod, exerting its greatest force to move the main shaft along the line of the cylinder. This force, being opposed by the main bearing, next exerts itself to deflect the cross head from a right line. The effect, being nullified by the guides, next exerts itself to revolve the main shaft, producing useful effort only on the third rebound.

We may also add that in an engine the combination of reciprocating parts with severe intermittent strains in alternate directions compels a large mass of foundation and fly wheels of undue proportions.

Now, having seen some of the disadvantages under which steam acts in producing rotary motion in a reciprocating engine, let us see wherein the rotary engine offers a more favorable means of converting steam expansion to rotary motion.

The steam on entering a rotary engine in motion impinges against a moving mass, and in such a manner that the impact and pressure alike exert themselves to revolve the main shaft. The full force of the steam is exerted with equal efficiency throughout the revolution, and in some designs at least the force of one impulse overlaps that of its successor, thereby producing a constant though slightly variable torque. Owing to these favorable conditions, only enough foundation is required to enable the weight of the engine to withstand the pull or thrust of transmission, and also permits of as high a rotative speed as economy will dictate, at the same time eliminating to a great extent the necessity for fly wheels.

Let us now see whether the rotary principle has not even greater points of superiority in its application to internal combustion engines.

We note that in an internal combustion engine of the reciprocating type the first stroke or half revolution not only is not productive of useful effect, but consumes power already developed, to the extent of the force necessary to move the piston connecting rod and produces a partial vacuum to draw in a charge of gas and air. The second stroke or half revolution is likewise void of useful effect, and is to be charged with the consumption of enough force to compress the charge of gas and air to form four to five atmospheres.

At this point the charge is ignited. The resulting raise, being practically instantaneous, produces a severe impact against the piston. Owing to the almost entire absence of angularity of the connecting rod relative to its crank, this impact is changed to heat, which in turn is dissipated by the water in the cooling jacket.

During the balance of this stroke or the first half of the second revolution the pressure due to combustion has not only to produce the proportional work of this stroke, but has to impart to the fly wheels enough energy to continue the revolutions until the next explosion occurs. The last half of the second revolution we find on the debit side of the ledger along with the first revolution.

We need scarcely add that an engine working under the above described circumstance must be limited to a very moderate piston speed and at the same time require massive foundations and fly wheels of excessive weight.

In summing up the advantages of the rotary internal combustion engine it must be remembered that this type of engine is in the incipient stages of mechanical development, and consequently the advantages we can now recite will be largely added to as a result of further development.

This much we already know: An internal combustion engine of the rotary type offers these advantages: The full force of each explosion is exerted to revolve the main shaft, the force having a constant efficiency and a constant though somewhat varying torque; absence of vibration and concussion; any rotative speed found convenient; elimination of heavy fly wheels and much decreased requirements of foundation; perfection of speed regulation superior to the best steam engine practice.

All of the above is accomplished with a reduction of from 50 to 75 per cent. per horse-power.

MINOR MENTION.

It is reported that the B. & O. Railroad will operate motor cabs at Washington, D. C.

The Wheeling Novelty Co., Wheeling, W. Va., is building an experimental gasoline carriage.

The Druid Hill Park Board, Baltimore, Md., have excluded gasoline carriages from its confines.

Charles S. Lee, Grove St., Plainfield, N. J., has taken the New Jersey agency for the Locomobile.

It is said that a line of electric omnibuses will be run from New Haven, Conn., to East Rock Park.

The Philadelphia City Council has passed the ordinance requiring the licensing of motor vehicles used for hire.

W. H. Dandurand, 246 St. James St., Montreal, Canada, is organizing a company to manufacture both electric and steam vehicles.

William M. Kendall, 354 Pine St., Manchester, N. H., writes that he is acting as agent for motor vehicle manufacturers.

The Munger Vehicle Tire Co. is a recent New Jersey incorporation, capital stock $600,000. Charles R. Flint is said to be interested.

F. C. Miller and O. R. Peters, retired capitalists, of Cincinnati, O., are erecting a factory at Newport, Ky., for the manufacture of motor vehicles.

The Buffalo Gasoline Motor Co. has been incorporated at Buffalo, N. Y., with $25,000 capital by Louis Langan, L. Belle Conrad and Louis A. Fisher.

The Phoenix Motor Vehicle Co. has recently been organized at Cleveland, O., with R. A. Rainey president, and E. P. De Gollier secretary and treasurer.

The plant and business of the tire department of the New Brunswick Rubber Co., New Brunswick, N. J., has been purchased by the Rubber Goods Co.

I. B. Dockweiler, C. Johnson, H. E. Carter, R. D. Morris and D. H. Laubersheimer, of Los Angeles, Cal., have organized the Automobile Co. of Los Angeles.

General Carriage stock shot up like a rocket in Wall St. last week, just why nobody seems to know, although various rumors of deals and consolidations were afloat.

The Milwaukee Automobile Co., capital stock $100,000, has been incorporated by W. H. Starkweather, Herman Pfiel and W. G. Smith to manufacture light passenger automobiles.

The Duplex Frictionless Engine Co. have taken a shop at 25 Wall St., Macon, Ga., for the manufacture of stationary, marine and vehicle engines, invented by Dr. A. J. W. Best.

Two motor vehicle companies, in one of which A. L. Barber, president of the Locomobile Co. of America, is said to be interested, are in process of formation at Washington, D. C.

It is reported that the Brooklyn rights under the General Carriage Co.'s charter have been secured by J. C. Church and others, who will operate omnibuses in that borough of New York.

The Diamond Rubber Co., Akron, O., have opened a New York office at 127 Duane St. and a Chicago office at 938 Marquette Building. O. J. Woodward is in charge of the New York office.

The Freeman Perfume Co., Cincinnati, O., asked permission of the city authorities to charge its electric automobile in front of its store, but the board directed that the work be done under the supervision of the electrician.

H. R. Illingworth and Joseph Lanz, Utica, N. Y., doing business under the name of the Utica Gas Engine Co., have invented a two-cycle gasoline vehicle motor of 2½ h.p., which they are to manufacture for the trade.

The management of the Cycle and Automobile Show to be held at Madison Square Garden during the week following Jan. 20 report that all the spaces on the ground floor are taken and that the only available stands now are in the galleries.

Lead Cab stocks are steadily falling on the New York curb. On Saturday New York Transportation was quoted at 10½ bid, Illinois Transportation at 2 bid and New England Transportation at 6½ bid. The wonder to the lay mind is how such stocks can have any quotations at all.

The motor vehicle trade is warned against one J. Hector Graham, doing business at 170 Summer St., Boston, Mass., under the name of the Graham Equipment Co., alias the Graham Equipment Motor Co. He misrepresents his standing and connections and is irresponsible.

H. A. Lozier, of H. A. Lozier & Co., bicycle manufacturers, of Toledo and Cleveland, O., will retire from active business this winter, and E. R. Lozier, his son, and George Burrell, mechanical superintendent, will organize a new company at Toledo to manufacture launches and automobiles.

Many persons in Buffalo, N. Y., are seeking licenses to operate motor vehicles, but none are to be had, because an ordinance covering the case drafted in 1898 and approved by the mayor has remained in abeyance in the Common Council. Action will probably be taken by that body at once.

C. G. Fisher & Co., bicycle dealers, Indianapolis, Ind., wish to arrange with some first-class manufacturers of steam and electric vehicles to represent them in the State of Indiana. From Jan. 1 W. G. Ribble, an experienced mechanical engineer, will have charge of their automobile department.

The Martin-Fefel Vehicle Co., capital stock $250,000, has been incorporated in New Jersey to operate electric and other vehicles. The incorporators are W. D. Lightfoot, New York; John Martin, Paris, Tex.; M. I. Hester, Brooklyn, N. Y.; Henry H. Fefel, New York, and Elmer H. Cohle, Jersey City.

At the foreclosure sale, Dec. 4, of the factory of the Brooklyn & New York Railway Supply Co., Elizabeth, N. J., the property was bid in by Chas. A. Lieb for the Riker Electric Vehicle Co., who have been occupying the premises for some time by permission. The price paid, with the incumbrances, will foot up about $100,000.

The Duryea Motor Co. has been incorporated in New Jersey with $1,000,000 capital stock, of which $100,000 will be 6 per cent. preferred. The new company has purchased the patents of Chas. E. Duryea, Peoria, Ill., and absorbed the business of the Duryea Mfg. Co., same place. Henry Crowther, New York, is president, and C. E. Duryea vice-president and superintendent. It is said a factory will be built in the East.

Users of steam carriages of the locomobile type will be interested to know that the Gleason-Peters No. 97 toggle-joint air pump will serve a double purpose for them. It will inflate the tires, and when the water is low and the carriage has come to a standstill in consequence it can be used to force water into the boiler against the pressure of the boiler, for which purpose a powerful pump is required.

The Woods Motor Cab Co., of Washington, D. C., and the Woods Motor Cab Co., of Detroit, Mich., were recently incorporated in New Jersey, each with a capital stock of $500,000—$200,000 preferred and $300,000 common. It is said that other companies will be organized in the large cities, and that both electric and "hot water" vehicles will be employed, the latter operating on the Prall system of the Storage Power Co.

Automobile Co. of America's New Factory.

The Automobile Co. of America have moved from 24 West St., New York, to a very large factory at Marion, N. J., on the lines of the Pennsylvania and Lehigh Valley railroads and the Newark and New York trolley.

The main factory consists of two buildings, one 260 x 30 ft. and four stories high, and the other 144 x 105 ft. and four stories high. In addition there are four smaller adjoining buildings for blacksmith shop, tool rooms, etc.

They are already in running order in the new premises and are making preparations to turn out eight carriages a week during the year 1900.

Among recent orders they report one from the Havana Transfer Co., Havana, Cuba, for four vehicles, and orders for delivery wagons from a number of the large department stores of New York and Brooklyn.

They now put three-cylinder motors on their carriages, giving 10 h.p.

Licensing Steam Vehicle Drivers in New York.

Quite a number of New York's aristocrats recently submitted themselves before the Steam Boiler Inspection Bureau of the New York Police Department for examination to determine their qualifications for the operation of steam carriages in the streets of the city.

Applicants are put through an oral examination lasting about three-quarters of an hour and covering the chief points in the construction of the boilers they are to operate and the various attachments thereof. The ceremony is performed by Sergeant Frank Mangin, Jr., at Police Headquarters, 300 Mulberry St. About a dozen licenses have so far been granted.

The Mercantile Manufacturing Co.

The New York daily newspapers have devoted considerable attention of late to the career of one George Percival Stewart, who has been advertising in one of the automobile magazines under the title of the Mercantile Mfg. Co., 38 Park Row, New York. This gentleman's antecedents are shown to be of such a decidedly shady character that the police or postal authorities have been compelled to step in on several occasions and put a stop to other schemes he has been engaged in in the past.

Sparking Points.

Baker & Co., refiners, of Newark, N. J., manufacture a special alloy for the sparking points of gas engine igniters, which they claim is almost indestructible, as they have had a pair of points made of this alloy in use on their own gas engine since the fall of 1894 without perceptible sign of wear.

These points are made in small pieces about ⅛ in. in diameter and 1-16 in. thick. They are very hard and have to be ground to shape on an emery wheel.

They also supply a special solder for attaching the points to the terminals in the combustion chamber.

MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 637,659—Compression of Air and Utilization Thereof.—Edward E. Pettee and John J. McCutchan, New York, N. Y., assignors, by mesne assignments, to the Automatic Air Carriage Co., of New York. Filed March 9, 1899. Serial No. 708,421. (No specimens.)

Claim.—1. The method of compressing air and utilizing the same.

The main feature of this invention consists in utilizing in the motor cylinder the heat of compression developed in the air compressor. In practice this result is said to be realized by discharging the condensed air as soon as compressed directly from the compressor into the adjacent motor by a short connecting pipe, jacketed by the exhaust pipe from the explosive engine which operates the compressor, the arrangement being such that the products of combustion from the explosive engine at a considerably higher temperature than that of the compressed air traverse the jacket surrounding the compressed air conducting pipe throughout the entire length of the pipe and pass through an annular passage or jacket exterior to the working cylinder of the motor, finally passing out through the motor cylinder exhaust.

Fig. 2.

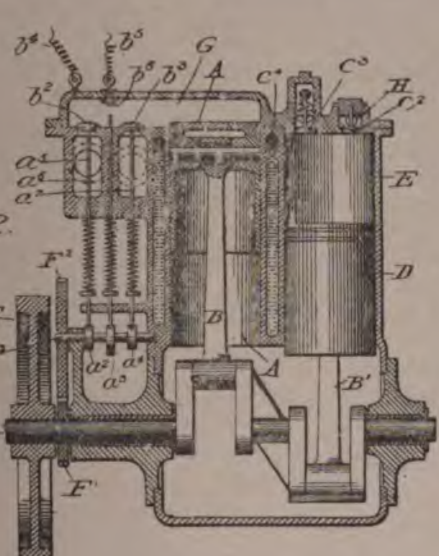


Fig. 3

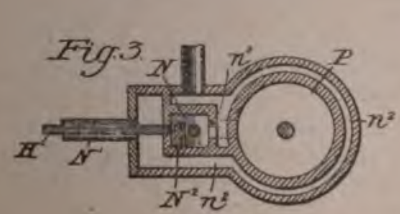


Fig.

A further feature consists in supplying the compressor with moist warm air, receiving its moisture at atmospheric pressure, at which pressure its capacity for holding moisture in suspension is greater than at any higher pressure or greater density at any given temperature. For the purpose of simultaneously warming and moistening the air supply of the compressor it is brought into contact with the water employed for supplying the water jacket for the explosive engine, whereby the air itself is made available for abstracting heat from the water and keeping it at the desired moderate temperature.

Fig. 2 represents in central vertical section the compressor and the explosive engine for operating the same, Fig. 3 a central section through the air motor and Fig. 4 a cross section through the air preheating and moistening tank.

A represents the cylinder of the explosive engine and A′ the piston connected by the oscillatory rod B with the crank shaft C. The piston D of the air compressing cylinder E is connected to the crank shaft C at an angle of 180 deg. to the crank connection of the engine cylinder by means of the rod B′.

Upon the outer end of the crank shaft C is mounted the balance wheel F, fixed to the shaft, as is also the gear F′, which meshes with the gear F^2, fixed to the cam shaft F^3 and of twice the diameter of the gear F′. Upon the cam shaft F^3 are fixed the cams a^2 a^3 a^4, adapted to actuate the corresponding rods a^5 a^6 a^7, provided with springs for maintaining their lower ends in contact with the surfaces of the cams. To the rod a^5 is attached the valve b^2, which governs the inlet to the engine. To the rod a^7 is attached the valve b^3, which governs the exhaust of the engine, and the rod a^6 terminates as a contact for closing an electric circuit through the conductors b^4 b^5. As the rod a^6 rises it makes electric connection with the insulated contact b^6, so that when the rod a^6 is withdrawn from the insulated contact an electric spark is formed to explode the mixture of gas and air or oil vapor and air within the space G. The explosion of the mixture causes the piston A′ to descend and drives the air compressor piston D upwardly, thereby compressing the air in front of the piston D and causing it to pass through the exhaust valve c^2 into the conducting pipe H. The air compressor cylinder is provided with an inlet valve c^3, which opens and permits the entrance of air into the cylinder E on the downward stroke of the piston D.

No. 637,302—Sparking Igniter for Explosive Engines.—George S. Strong, New York, N. Y., assignor to John P. Murphy, Philadelphia, Pa. Original application filed Dec. 15, 1898. Serial No. 699,312. Divided and this application filed May 5, 1899. Serial No. 715,697. (No model.)

P indicates the head of the gas engine cylinder, having water passages formed in it, as is shown, and also having the perforations P^6 and P^7.

P^{10} p^{11} are non-conducting thimbles secured in the opposite ends of the perforation P^6 and supporting the conducting rod Q, the outer end of which is placed by a conductor (not shown) in communication with the one pole of the battery or generator, while the inner end, Q′, extending into the head a of the cylinder, is curved, as shown, and provided with a contact point, q′.

p^7 is a non-conducting liner fitting in the perforation P^7 and, as shown, extending for some distance above the outer end of the perforation, but not extending entirely to the inner end of the perforation, thus providing a cylindrical chamber, P^9, immediately adjacent to the cylinder head a. The outer end of the liner p^7 is slotted, as indicated at p^8.

Q^4 is a conducting rod fitting and longitudinally movable in the liner p^7 and provided at its outer end with a key, as indi-

Fig. 1

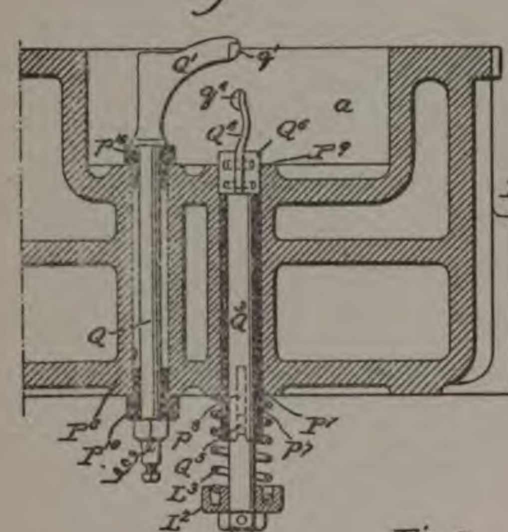
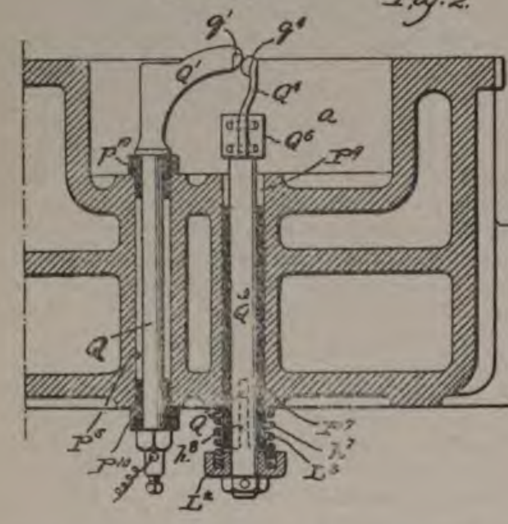


Fig. 2.



cated at Q^8, said key fitting in the slot or slots p^8 and preventing the rod Q^3 from turning in the liner. To the inner end of the rod Q^3 is secured an elastic finger, Q^4, having at its outer end a contact point, q^4, so placed and arranged as to come in contact with the contact point q' when the rod Q^3 is thrust inward to the position indicated in Fig. 2, the elastic finger Q^4 being so shaped as to insure contact with some pressure. Also secured to the inner end of the rod Q^3 is a pistonlike extension, Q^6, arranged to make a nice fit with the cylinder Q', already described. As shown, the outer end of the rod Q^3 is provided with a head, L^2, between which and the outer face of the casting P is secured a spring, L^3, acting to force the rod Q^3 outward. Pressure to force the rod inward is applied by a cam or any other convenient device acting on the head of the rod Q^3 or its cap, L^2. It will be understood, of course, that the rod Q^3 is connected by a conductor with the opposite pole of the battery or generator to that connected with the rod Q.

In operation the rod Q^3 is forced inward to the position indicated in Fig. 2, is then released, and the spring L^3 draws it rapidly outward, a spark occurring when the contact points q^4 and q' break contact with each other. After the formation of the spark the rod Q^3 is drawn to the position indicated in Fig. 1; but before reaching that position the piston Q^6 enters the cylinder P^9 and is cushioned on the air in said cylinder, so that the latter part of its movement is checked and all noise and destructive shock avoided.

N' and N' indicate bearings for the crank shaft formed in the casings N, N^2 N^2 indicating hard steel bearing disks and N^3 rollers.

c indicates the crank disk proper, which in my preferred construction I provide with a steel or iron "rim" or "tire," so to speak, C. In the disk c I form a cylinder, C', which may conveniently extend through the disk proper, c, as clearly shown in Figs. 7, 8 and 9, the cylinder lying transversely through the center of the disk and being provided with a slot, C^2, on the front of the disk. On each side of the central cylindrical passage I form in the disk c parallel passages, which may conveniently also be cylindrical, as indicated at C^3 C^3, and at convenient points, preferably at right angles and through the center of the disk, I form connecting passages, C^4 C^4, opened toward the face of the disk and provided with journal bearings, C^5, at their bottom.

C^6 C^6 indicate blocks or plates for closing the face of these openings C^4, which are formed in journal bearings C^7, facing the bearings C^5, as is best shown in Fig. 9.

C^8 indicates a port or channel formed in the disk c, opening near the periphery of this disk into the cylinder C', as shown in Fig. 8, and at the center of the disk into the projecting stud B, so as to communicate freely with the channel A^2 in the crank shaft.

No. 637,298—Gas Engine.—George S. Strong, New York, N. Y., assignor to John P. Murphy, Philadelphia, Pa. Filed Dec. 15, 1898. Serial No. 699,312. (No model.)

The leading features claimed are a novel combination of a four-cylinder engine with a two-crank shaft, whereby an explosion takes place for each half revolution of the shaft.; a novel valve or valve and igniter mechanism characterized by great simplicity and applicable with advantage to two-cylinder engines, although especially adapted for the four-cylinder type; a novel device for governing the action of the admission valves; improvements in the starting mechanism, in the igniting mechanism, and in the construction and combination of the shaft, fly wheel and shaft bearing, which improvements, though illustrated in the drawings, form the subject matter of other divisional applications.

Fig. 4 is a side elevation of the engine on an irregular section line. Figs. 20 and 21 are views showing the form and disposition of the six cams used to actuate the admission and exhaust valves and the igniters.

For the four-cylinder engine two cams are employed to operate the four admission valves, two other cams to actuate the four exhaust valves, and two other cams to actuate the igniters, each acting alternately on the valves and igniters of two cylinders, the pistons of which are coupled to move as one. The admission cams are secured directly to the keys I^7 and I^8, so that besides rotating with the shaft K^4 they move longitudinally along with this shaft in a direction to an extent determined by the position of the shaft governor. The cams actuating the exhaust valves are indicated at m^2 and m^3. Their hubs, M^2 and M^3, are secured directly to the shaft K^4, as are also the cams m^4 and m^5, the hubs of which, M^4 and M^5, are also directly attached to the shaft. The cam shaft

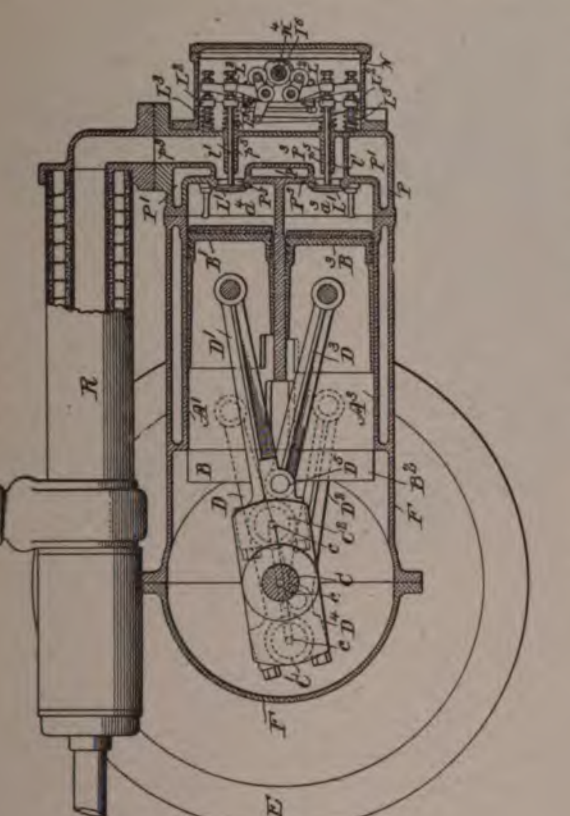
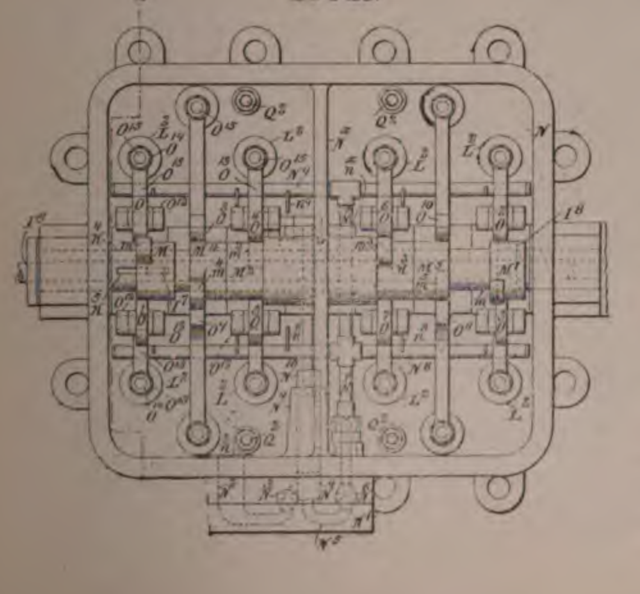


FIG. 4.

passes through a box, N, in which are situated bearing rods, N^{12} N^{12}, etc., said rods being supported in studs n n^x, the latter of which extends from a central web, N^x, in the box N, and serving to support the hubs o^{12} o^{12}, etc., of a series of twelve valve-actuating lever arms, O^{13}, arranged in pairs and extending in opposite directions on each side of the shaft K^4. The levers O^{13} appertaining to the admission and exhaust valves are formed, as best shown in Figs. 22 and 23, with perforated heads, O^{14}, at their outer ends and with upwardly extending

FIG. 15.



arms, O^{13}, connected with the hub and adapted to support cam rollers, O and O′ indicating the cam rollers acted on by the admission cam m, O^2 and O^3 the rollers acted on by the admission cam m′, O^4 and O^5 the rollers acted on by the exhaust cam m^3, and O^6 and O^7 the rollers acted on by the exhaust cam m^2, and the admission cam rollers O′ and O^3 are formed and arranged so that as the cams m and m′ move toward the right they will move out of the path of these rollers before they move out of the path of the rollers O and O^2. In this way the first effect of the governor when the engine is unduly speeded is to cut off the admission to all of the cylinders, reducing the explosions to one for each complete revolution of the shaft, and then if the speed still exceeds the normal the cams will clear the rollers O and O^2, in which case no explosive gas is admitted to any of the four cylinders.

Referring next to the levers used in connection with the igniters, it will be noticed in Figs. 20 and 21 that the igniter cams m^4 and m^5 are formed with abrupt rear shoulders and in Figs. 24 and 25 that the valve actuating levers O^{13} are on one side of the cam shaft provided with upwardly extending arms, as O^8, having a downwardly looking abrupt shoulder, o^8, while

FIG. 20.

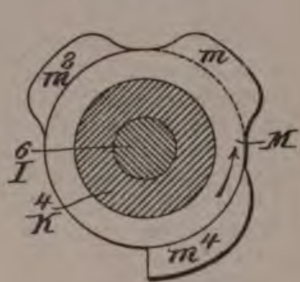
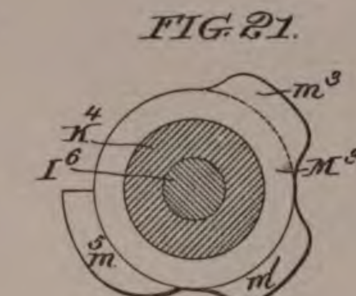


FIG. 21.

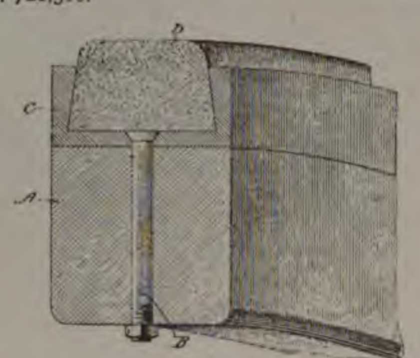


on the other side of the cam shaft the upwardly extending arm O^9 is made with an upwardly abrupt shoulder, o^9. It will thus be seen that the cam roller, revolved to the right, will, after depressing the levers O^{13} successively, suddenly leave contact, permitting the lever to snap back under the impulse of the springs, which are arranged to act upon them.

Claim.—A gas engine having four cylinders arranged side by side on one side of the shaft and pour pistons working therein and coupled in pairs to two oppositely lying cranks on the shafts, admission and exhaust valves leading to and from each cylinder, a rotating cam shaft extending across the head of the engine cylinders as described, two exhaust valve cams secured on said shaft, two admission-valve cams rotating with but longitudinally movable on said shaft, a governor

and connections therefrom to regulate the longitudinal shifting of the admission cams, two pairs of exhaust valve actuating levers, each pair being arranged to be operated alternately by a rotating cam and two pairs of admission valve actuating levers, each pair being arranged to be alternately actuated by one of the governor controlled cams and one lever of each pair having its cam contacting end arranged to remain in the path of the shifting cam after the cam contacting end of the other has moved out of said path.

No. 637,691.—Wheel for Automobiles or Other Vehicles.—James C. Anderson, Highland Park, Ill. Filed June 14, 199. Serial No. 720,516.



This invention consists in providing the rim of the wheel with a steel or other suitable metallic circumferential box or tire receptacle of peculiar form and arranging therein and projecting therefrom a tire proper or tread surface composed of asphaltum and other ingredients.

No. 632,913—Sept. 12, 1899—Gas Engine.—Franz Burger, Fort Wayne, Ind., assignor of three-fourths to Hy. M. Williams, of same place.

Fig. 1 is a side view of a duplex gas engine embodying the improvement, and Fig. 2 a longitudinal plan in part section.

It is desirable, in order to save room and render the engine compact, to have the cylinders on the same horizontal plane with the shaft; but this cannot be done when it is necessary to have both pistons at the ends of their outstrokes at the same time and yet arrange the engines in line. Thus, as shown in Fig. 2, the crank shaft A has two cranks, 3 3, arranged between disks 4 5 6. The disks 4 6 are connected with different sections of the shaft. Each piston E is connected by a rod, D, with the opposite crank, so that the pistons alternately recede and approach each other simultaneously. The two sections of the crank shaft pass through packing boxes in the detachable heads of a casing, F, which incloses the crank disks 4 5 6, and which communicates with the inner end of each cylinder, C C'. The outer end or head 8 of each cylinder has a somewhat contracted central port, S, and about the center of the cylinder are the exhaust ports 9, communicating with the exhaust pipe and arranged to be closed and uncovered by the piston, as is common in some classes of gas engines.

An objectionable feature incident to ordinary constructions of gas engines is the tendency to premature ignition of the charge resulting from the introduction of the fresh charge into the cylinder, projecting the fresh charge centrally among the heated gases, some portions of which are either ignited or so hot as to ignite the new charge before the piston reaches the end of its back stroke. It is claimed that this result may be overcome by providing a comparatively restricted inlet port, S, at the end of the cylinder and at the rear

Fig. 1

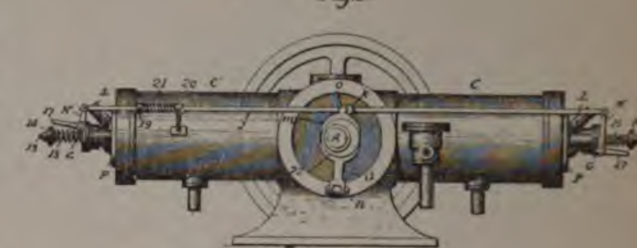
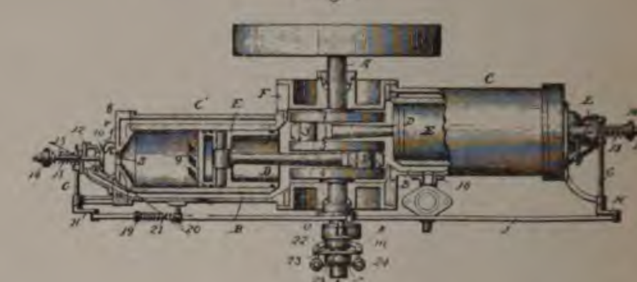


Fig. 2



of the latter and explosion chamber, R, so that when the charge under pressure passes from the restricted inlet port 10 into the explosion chamber at a high rate of speed it will have an opportunity to expand and its speed will be reduced before it enters the cylinder. As a result, it is not projected forward through the center of the hot gases prior to being exploded, but remains and fills the explosion chamber, flowing out slowly until the piston reaches the end of its outstroke, when the charge is exploded in the explosion chamber by means of the igniter L, of any suitable character, the said igniter communicating with the explosion chamber, so that the flame will ignite the whole mass of the fresh charge in the explosion chamber instantaneously. The inventor says that by this means he can secure a more rapid combustion, insure an ignition of every charge, and obtain more power from a weaker mixture than heretofore. While these results may be effected with different constructions, he prefers to form the explosion chamber in a casing, T, bolted to the head of the cylinder and provided with an inlet port, 10, to which is adapted a valve, 12, having a stem, 13, extending through the end of the casing and carrying an adjustable collar, 14, against which bears a spring, 15. It will be understood that normally the valve will rise and permit the inflow of the new charge as the piston moves inward, that the charge is compressed in both cylinders as the pistons move outward, and the explosions take place in both cylinders when the pistons are at the limits of their outward strokes.

While the gaseous mixture may be mixed in and forced from any suitable chamber, use of the casing F as a mixing chamber and compressing chamber is preferred. The inlet port 16 is supplied with the mixture of gas and air in any suitable manner, and when the two pistons move outward the mixture is drawn through the port into casing F and into the inner ends of the cylinders. When the pistons next move inward toward each other the gases are compressed; a check valve in the inlet casing a prevents any back flow through casing, and the compressed gas is forced through channels B B in the cylinders into the space at rear end of each valve 12.

Any governing appliances may be employed to regulate the speed, but he prefers to lock each valve 12 to its seat, so as to

prevent the introduction of any fresh charges as soon as the engine exceeds its normal speed. This is effected by means of a locking arm, 17, upon a rock shaft, G, turning in bearings upon the casing P, the arm 17 when in its horizontal position presenting its end in front of the sleeve 14 and holding valve 12 to seat. From each rock shaft G extends an arm, H, and the two arms are connected together by a rod, J, and between a collar, 19, on the rod and a guide bracket, 20, intervenes a spring, 21, which tends to throw the connecting rod to the left and to bring each arm 17 into a position to lock the adjacent valve in place. Means are provided whereby the rod J is reciprocated at each rotation of the shaft A, so as to lift both arms away from the collars when the valve should open and the governor throws such operating means out of action when speed is excessive. Thus a lever, Q, is pivoted at its lower end, n, so as to swing both laterally and outwardly, and has a yoke, m, in which turns an eccentric, 22, upon the shaft A, whereby the lever Q is reciprocated, and a pin, o, thereof is brought against a pin, k, of the connecting rod J at each rotation of the shaft A, thereby lifting the arms 17, so as to leave the valves 12 free to move. The yoke m is provided with a hub, 23, recessed to receive the inner ends of weighted crank levers, 24, pivoted to a cross piece, 25, carried by the shaft A, and connected by a connecting spring, 26. This construction constitutes a governor the weighted arms of which swing outward when the speed is excessive, drawing out the upper end of the lever Q, and carrying the pin o away from the pin k, so that the arms 17 then remain in position to lock the valves 12 in place.

Fig. 3 illustrates a single-cylinder engine, with the valve 12, chamber R outside the port S and valve operating appliances the same as in the double-cylinder engine. In this case also the crank turns in a casing, F, and there is a passage, B, as before.

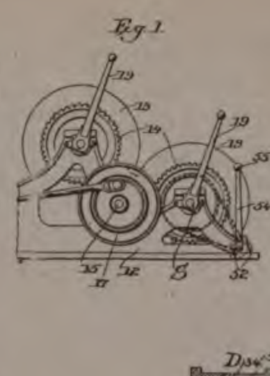
Two claims. Application filed June 18, 1897.

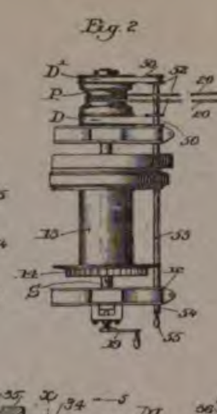
No. 638,184—Nov. 28, 1899—Driving Apparatus.—A. E. Norris, Cambridge, Mass.

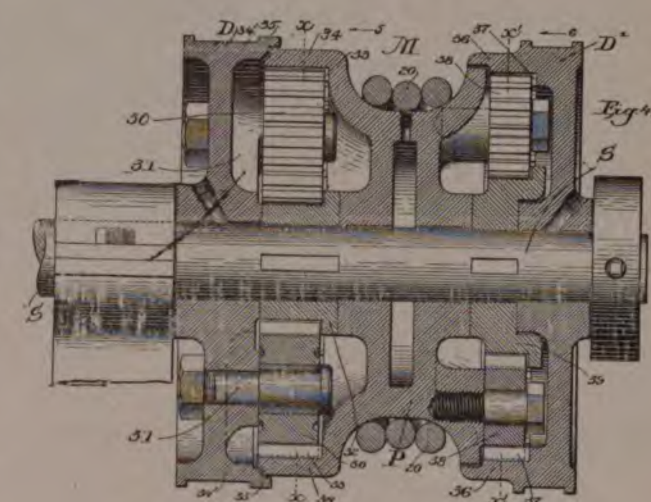
Fig. 1 is an elevation of a portion of a hoisting device. Fig. 2 is a plan of a hoisting drum. Fig. 3 is a plan of bow wheel of a derrick. Fig. 4 is a section of the driving apparatus. Fig. 5 is a sectional elevation of driving apparatus, section taken on line x x in direction of arrow 5. Fig. 6 is a similar view looking in direction 6.

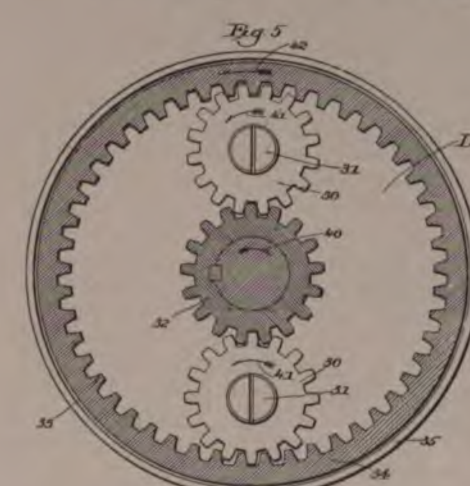
The disk or member D of the driving mechanism carries two pinions, as 30, located at equidistant points from the axis of motion of the shaft S and conveniently carried by journals 31 on the web of the disk, the journals ordinarily consisting of bolts, and these pinions 30 mesh with a third pinion, 32, keyed to the shaft S, and also with the internal ring gear or circular rack 33, formed on the flange 34 of the intermediate member or drum P of the driving apparatus, and the disk D is peripherally grooved, as at 34′, to receive a strap constituting a convenient holding apparatus for said disk, and by forming this groove the annular projections 35 are produced upon the outer surface of the disk, which serve to prevent side motion of the strap brakes, and the disk D′ is similarly constructed for the same purpose. The inwardly extended flange 36 of the disk D′ is toothed, as at 37, to form a circular rack, and the teeth mesh with the pinions 38, which in turn mesh with a larger gear, 39, keyed to the shaft S, said pinions 38 being located at similar distances from the axis of the shaft S and are journaled on the drum P. Both trains of gearing are of the planet and sun type, this being a convenient form.

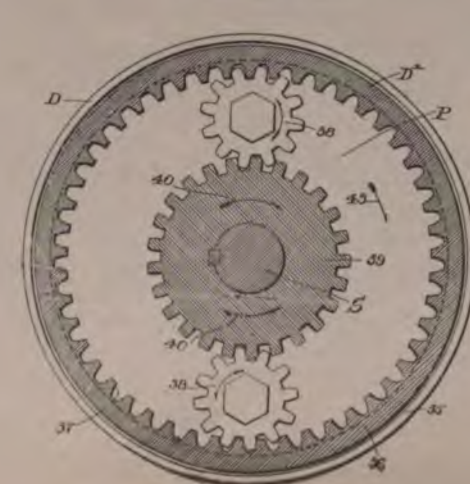
From the preceding description it will be evident that when both disks D and D′ are free from any restraining influences











the intermediate drum or power transmitting member of the combination is not operated; but when either of them is blocked the motion of the said part P will follow, and it will be in reverse directions, respectively, in accordance with the element D or D′ that is limited.

Let it be assumed that a friction brake passing around the periphery of the disk D is thrown into action. This will result in holding said disk, and consequently will prevent orbital movement of the two pinions 30 about the shaft S, which shaft rotates in the direction of the arrow 40 in Fig. 5, the pinion 32, which is keyed to said shaft, being of course moved in a corresponding direction, and as the pinions 30 are for the time being fixed against revolution they are caused to rotate in the direction of the arrow 41 in said figure, and being in mesh with the internal ring gear or circular rack 33, formed on the flange 34 of the power transmitting member P, they cause said power transmitting member to rotate in the direction of the arrow 42. When the disk D is freed and the brake applied to the disk D′, it of course will be prevented from rotating, although, of course, the shaft S and the gear 39 move in the direction of the arrow 40 in Fig. 6, and as the disk D′ is blocked the gear 37 will also be held, so that by reason of the intermeshing of the teeth of the gears 39 and 37 with the intermediate pinions 38 the latter will be caused to travel orbitally about the shaft S in the direction of the arrow 43 in said Fig. 6. The power transmitting member P is correspondingly operated, and the direction of course will be exactly opposite to that taken by the shaft S when the brake of the disk D is set. When no resistance is applied to either disk, of course they are oppositely rotated.

It will be evident that by turning the power transmitting member P the bow wheel 21 can be moved in a similar direction for the purpose of turning the mast of the derrick or a similar appliance through the intermediate band or rope 20.

Any convenient means can be employed for holding the two disks alternately, although for quickness of action he prefers to employ separately effective brakes, both manually controlled and each comprising a strap or band, as 50, adapted to pass around the peripheries of the disks D and D′ and to be connected at their ends to rockers, as 52, secured to the rock shaft 53, journaled in suitable bearings upon the framing 12 of the hoisting apparatus hereinbefore briefly described, and said rockers of course are alternately effective, and the ends of the strap brakes are connected to said rockers, and the operation is such that by turning the shaft 53 in one direction one of the brakes will be tightened and by turning said shaft in the opposite direction the other brake will be set, whereby the disks D and D′ can be rendered effective, and it will be understood that when one disk is blocked the other will be released, and vice versa.

The shaft 53 is provided at one end with a lever, 54, equipped with a handle, 55, by which it can be readily operated to control the two strap brakes.

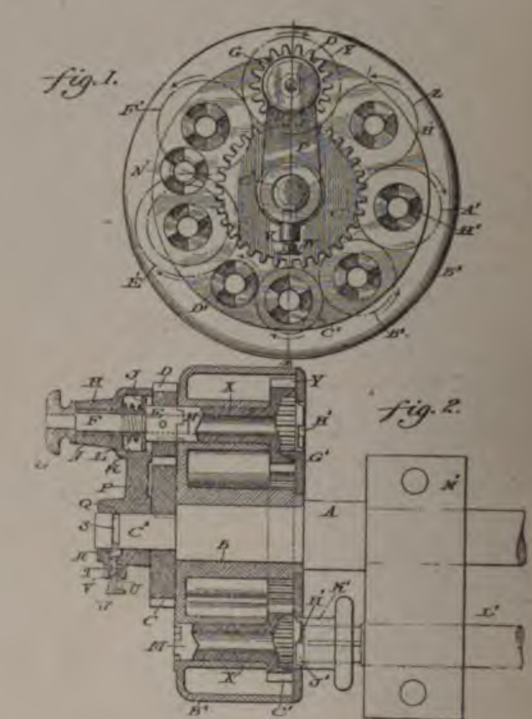
From the preceding description it will be evident that the apparatus involves a shaft, two main members (shown as parts D D′) loose thereon, an auxiliary member (shown as the intermediate part M), also loose upon said shaft, and two independent power transmitting mechanisms, each including three elements, the three elements of one power transmitting mechanism being carried, respectively, by the said shaft, a main member and the auxiliary member and the three elements of the other power transmitting mechanism being carried, respectively, by the shaft, said auxiliary member and the other main member and the first elements of each power transmitting mechanism being fixed to said shaft and the intermediate ones being rotative upon their supports.

It will be understood that when neither of brakes is set the disks D and D′ will be oppositely rotated through the intermediate gears; but these motions will not be transmitted to the intermediate part P, which is held against operation by the resistance imposed by the band or cable 20 thereon.

Six claims. Application filed June 17, 1899.

No. 638,359—Dec. 5, 1899—Variable Speed Mechanism.—W. L. Schellenbach, Philadelphia, Pa.

Fig. 1 is an end elevation of a variable speed mechanism embodying the improvement. Fig. 2 is a section on line x x, Fig. 1.



The operation is as follows: When a desired speed is to be imparted to the feed shaft or screw rod D^2, the housing B× is rotated until the proper gear therein can be brought in position to engage with the clutch B^2 on the portion C^2 of said screw rod D^2. The stem F is then pulled outwardly, the member E leaves the clutch member M, and the arm P is rotated until the member E is opposite the desired clutch member M, whereupon the parts E and M interlock. Thus the speed is imparted from the gear 1 by the transmitter 2 to the sleeve gear Z′, which passes through the housing B× and is secured to gear C, gear C meshing with and driving gear D, which imparts motion to clutch member E, which engages clutch member M, secured to the various sizes of gears contained within the housing B×, these gears of various sizes having clutched faces and being adapted to engage the clutch B^2, which rotates in unison with the screw rod D^2.

The arm P can be readily removed from its support C× by properly manipulating the head W.

Eleven claims.

Application filed May 2, 1899.

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

FOR SALE.

LOCOMOBILE—First-class running order. Price reasonable.

"H.," P. O. BOX 186,
Rochester, N. Y.

WANTED.

Catalogs, prices, etc., from manufacturers of steam and gasoline motor machines, who want first class representatives in Indiana. We expect to engage largely in the Automobile business and are prepared to represent, in a first-class manner, any line we select. C. G. FISHER & CO., Indianapolis, Ind.

BODIES FOR MOTOR VEHICLES. We have just completed twenty Hansom Bodies for the Columbia and Electric Vehicle Co., using *our own* patented door and window operators, and are in a position to build anything in that line. Do you want anything in Automobile bodies? QUINSLER & CO., Cambria St., Boston, Mass.

THE JUMP SPARK LEADS
Give Thick
1 Inch Jump Spark.
Weight, 3 lbs.
Dimensions, 8 x 4 x 4 ins.
Patent Applied For.
C. F. SPLITDORF, ELECTRICAL SPECIALTIES.
21 Vandewater St., New York.

Graphite Lubricants,

ALL KINDS, ACCORDING TO WANTS.

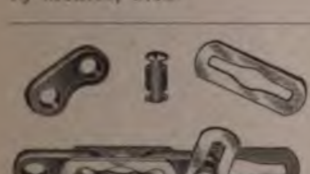
Special preparations for Gears of Electric Motors and for Cylinders of Motor Engines. Send for Circulars and Prices.

Joseph Dixon Crucible Co., - Jersey City, N. J.

A gentleman of good appearance, age 40 years, very highly related in Europe, established in New York 10 years, who can give the highest references, would accept the agency of one of the leading Horseless Carriage manufacturing firms of the United States during the coming Paris Exposition. Speaks and writes fluently English, French, Italian, German and Spanish, and is well known amongst the swell people of Paris. Address offers to RESPONSIBLE, care of this paper.

MAKERS OF STEAM VEHICLES

wishing representation in Mexico, are invited to correspond with undersigned, agents for Baldwin Locomotive Works, Westinghouse Electric and Manufacturing Co., and other leading American Manufacturers. G. y O. BRANIFF & CO., Calle de Cadena, 19 Mexico, Mex.



BALDWIN DETACHABLE CHAINS made for Automobiles, in sizes to suit all requirements. Prompt deliveries made. Address:
BALDWIN CYCLE CHAIN CO.,
WORCESTER, MASS., U. S. A.

Seamless Cold Drawn Steel Tubing, Shells, Cylinders and Tanks, For Air, Gas, Steam, Ammonia or fluids under pressure and explosives. Seamless Steel Tested Tanks of Sundry Diameters.

DROP FORGINGS AND STEEL STAMPINGS.

JANNEY, STEINMETZ & CO., Drexel Building, Philadelphia, Pa.

DRY BATTERIES
For Sparking Gas and Gasoline Motors.

LONG LIFE, RELIABILITY, HIGH VOLTAGE.
IN SUCCESSFUL USE FOR THIS PURPOSE.

Dow Portable Electric Assistant Co., 218 TREMONT ST., BOSTON, MASS.

LEONARD HUNTRESS DYER,

Specialty: Patents and Patent Causes,

908 G Street, N. W.

Cable Address: "Dyerpatent, Washington." WASHINGTON.

GASOLINE ENGINE CASTINGS.

One to four h. p., for stationary marine or vehicles; rough or partly finished. Also complete engines, carbureters and accessories. LOWELL MODEL CO., Box 292, Lowell, Mass.

AUTOMOBILE CHARGING AND REPAIR STATION

We Make, Rent, Recharge and Repair
STORAGE BATTERIES.
THE STORAGE BATTERY SUPPLY CO.
Established 1891. Telephone, 1065 Madison Square. Incorporated 1898
OFFICE AND WORKS: 239 East 27th St., New York City.

Fifth National Exhibition

— OF —

Cycles, Automobiles and Accessories,

Madison Square Garden, New York City, January 20th to 27th, 1900.

List of Exhibitors Published Next Week.

Applications for space can be made to
FRANK W. SANGER,
Pres't National Cycle Exhibition Co.,
Madison Square Garden, New York City, N. Y.

s illustrates our **MOTOR VEHICLE TIRE,** made according to the ideas of **the best** **xperts—the users of tires.** We have made a great variety, a great variety have tested them on a variety of roads, and this is the **net result** of a great many experiments.

DON'T FOOL YOUR TIME AWAY WITH UNTRIED TIRES.

WRITE FOR PRICES.

E GOODYEAR TIRE AND RUBBER COMPANY, Akron, Ohio.

WOODRUFF PATENT SYSTEM OF ING

Is used by The Largest Automobile Works in this Country. For Keying Gears, Sprockets, Cranks, etc., to Shafts. . . . .

WE CARRY 41 SIZES OF KEYS AND CUTTERS IN STOCK.

SEND FOR CIRCULAR.

THE WHITNEY MANUFACTURING CO.,

HARTFORD, CONN., U. S. A.

h X 4½ for Stationary Engines.
7 high X 4 for Automobiles.

O K DRY BATTERY.

NEW GAS ENGINE TYPE.

THE PROBLEM SOLVED.

No solution to slop over. No missing of sparks. Highest voltage. Quickest recuperation. Long life. Unaffected by heat or cold. Compactness.

Non-Polarizing Dry Battery Co.,

625 BROADWAY, NEW YORK.

POINTS IN ORDERING.

1. Name of engine.
2. Number of revolutions per minute.
3. Number of sparks per minute.
4. Mode of ignition, whether by spark coil or induction coil.
5. If spark coil, whether butting or wiping spark.
6. Kind of spark contact points, whether platinum, steel or other material.
7. Average number of hours per day engine is run.

Two Passenger Phaeton. Price, $1,220.00.

GASOLINE MOTIVE POWER

is what they use in France with Double Cylinder Balance Engines. We have the most perfect system on earth. **A Pleasure Trip from Kokomo, Ind., to New York, distance 1,050 Miles,** was made by one of our Phaetons at the **average rate of 14 miles per hour.**

The best record yet made in America and only slightly surpassed on the fine Boulevards of Europe.

We manufacture these carriages in TWO, FOUR and SIX Passenger capacity. We fill orders promptly and build HIGH CLASS CARRIAGES ONLY. We furnish circulars free, and our large catalogue for **10** Cents.

Order Carriages now for Spring delivery. If you wait you won't get one.

HAYNES-APPERSON CO., KOKOMO, INDIANA, U. S. A.

EXPLOSIVE MOTOR NUMBER.

TO be issued January 17th. Dealing thoroughly with gasoline, kerosene, alcohol, etc., vehicle motors and motor vehicles. Leading articles by **R. I. Clegg. E. J. Stoddard, P. M. Heldt, Herbert L. Towle, P. L. Tygard** and others. **Eighty pages,** many illustrations. **Ten cents,** stamps or coin. **Subscription:** Domestic, $2.00; foreign, $3.00 a year in advance.
☞ Send for our **STEAM BOILER NUMBER OF DECEMBER 6, 1899,** 10 cents.

THE HORSELESS AGE, 150 Nassau Street, N. Y. WEEKLY ESTABLISHED 1895.

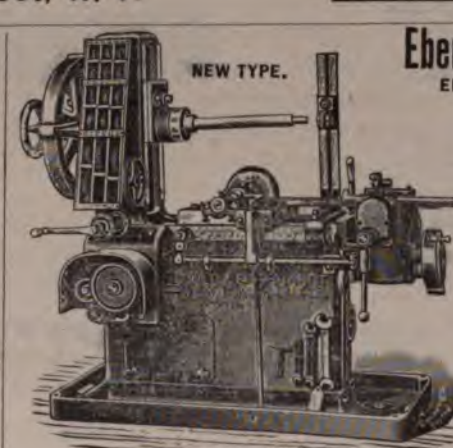
WE MAKE BEARINGS

THE BALL BEARING CO.

BOSTON, MASS.

GET OUR CATALOG.

FOR MOTOR VEHICLES.



"VICTORIA."
24 in., 33 in., 43 in., 63 in., 73 in. and 103 in.

Eberhardt's Patent
ENTIRELY AUTOMATIC

GEAR CUTTING MACHINES

WITH
Eberhardt's Patent
"Radial Duplex" Gang Cutters.
2 to 10 teeth finished at once.

GOULD & EBERHARDT,
NEWARK, N. J.

STEAM IS THE BEST POWER FOR AUTOMOBILES

Steam Motor Wagon.

THIS STYLE NOW READY.

OTHER STYLES TO FOLLOW.

THE Carriage illustrated here is one that will satisfy the most critical, for in it is combined the finest carriage work and the best machinist skill and workmanship, and it is the most practical and satisfactory pleasure carriage one can have.

FOR FULL PARTICULARS AND PHOTOGRAPH ADDRESS

STANLEY MANUFACTURING CO.,

No. 117 LINCOLN STREET, BOSTON, MASS.

MOTOR WHEELS.

STEERING DEVICE

WITH

BALL BEARINGS.

RIMS. CRESCENT SHAPE AND FLAT BASE

FLARING EDGES IF DESIRED.

WESTON-MOTT CO., UTICA, N. Y.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. V. NEW YORK, DECEMBER 20, 1899. No. 12.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

"A Little Brief Authority."

President Clausen, of the New York Park Board, has again placed himself in a strained position. He has undertaken to limit the automobiles entitled to enter Central Park to open carriages of the Stanhope type, excluding cabs and coaches as old-fashioned and more likely to frighten horses. The occasion of this new display of authority on the part of the President of the Park Board was the entrance upon his sacred domain of an electric coach loaded with merrymakers and operated by one of the uniformed motormen of the Lead Cab Trust. The permit on which the freedom of the Park was sought by the motorman, belonging to a high official of the Lead Cab Trust, was subsequently revoked by President Clausen for the reason above cited and because it had been transferred to another.

The term pleasure vehicle is one of wide latitude, although manifestly not including all vehicles which might temporarily be used for pleasure purposes. Trucks, delivery wagons, hay wagons, and, in fact, almost any kind of vehicle may be and is occasionally used for recreation or amusement. Such vehicles, however, would scarcely be entitled to park privileges, though decked out for a holiday and carrying pleasure seekers instead of their wonted merchandise. But cabs and coaches obviously belong in a different category. Though they are used for both business and pleasure, they are passenger and not freight vehicles, and as such come properly withiu the general class of pleasure vehicles, although not exclusively such. If we observe the types of horse vehicles which gain admittance to the Park we shall find a great variety of them, modern and old-fashioned, heavy and light, public and private, some employed wholly for pleasure, others serving also a business use. This heterogeneous assortment of conveyances has one characteristic in common, apparently, and only one—they are all passenger vehicles.

On grounds of logic, therefore, the attempt of the President of the Park Board to discriminate against certain types of motor pleasure or passenger vehicles and limit his permits to one or two types is unwarranted and tyrannical. The holder of a Park permit is entitled to enter in any style of pleasure vehicle he chooses, and if he wishes to employ a professional motorman to conduct his vehicle it is as much his right as to retain a coachman for his horse carriage.

These are plain and indisputable truths, which he who runs may read, and which would be upheld by any judge in the land. In so flatly contradicting them President Clausen has again allowed his zeal to overmaster his judgment and stolidly set himself in the path of progress. Friends of the automobile had fondly hoped that his conversion was complete, and that he would make amends for his ultra conservatism by a liberal construction of the Board's ruling on automobiles. But he is proving a backslider, and to avoid further vexatious wrangling and delay it would probably be better for all concerned to have

the matter tested in the courts and the exact limits of President Clausen's authority fixed by legal decree. Automobilists need have no fear of the character of that decree. If pushed to an ultimatum it would abolish forever this Park permit practice.

A Cuban Example.

It is cheering news we receive from Havana, Cuba, this week through one of our esteemed subscribers, Ramon V. Williams, for many years United States Consul at Havana and now actively engaged in developing the commercial resources of the island. Under his management a company has been organized there for the establishment of motor vehicle services in and around Havana and further inland. A number of gasoline vehicles are already in practical operation on suburban routes. In actual use of the commercial motor vehicle, therefore, Cuba is in advance of the United States, which furnished the vehicles for the enterprise.

This news, so fraught with blessing for our West Indian neighbor, which has long suffered from a lack of transportation facilities, should serve us as a reminder of our own needs in the line of improved motor transportation and of the well-nigh limitless demand for business vehicles of all kinds that is coming from the far corners of the earth. Scarcely a country on the map but is waiting for some kind of a motor vehicle to develop its internal resources or lighten the labor of travel.

With this inviting prospect before us, it is high time we were up and doing for ourselves as well as for others. Let us brush aside the promotions and the fads, that have engaged too much of our attention, and make room for business.

Explosive Motor Number.

Our Explosive Motor Number of Jan. 17 bids fair to be even more valuable than our Steam Boiler Number, because the subject is newer and original data and speculation thereon are not easily obtained. The Horseless Age is assisted in its educational work, however, by a staff of engineering contributors who are pioneer investigators in this productive branch of engineering in the United States and realize the benefits to be derived from a free interchange of experience and opinion at this time. We shall therefore be able to give to our readers the most comprehensive treatise on the explosive vehicle motor that has yet appeared in any technical journal. Balancing, mixtures, odor, mufflers, multi-cylinders, noise, ignition, cycle, weight, cooling, etc.—all the questions which are puzzling the gasoline engine experimenter—will be treated by competent experts, from whose combined knowledge, we feel confident, the gasoline vehicle will be presented to us in clearer light than ever before, so that we may more intelligently apply ourselves to its perfection. A very large edition will be printed and sold.

Lead Cab Finale.

The Lead Cab Trust is apparently in desperate straits. From the chief conspirator, the Electric Storage Battery Co., of Philadelphia, down through the long list of dummy manufacturing and operating companies, its stocks are on the decline. A recently declared dividend of 2 per cent. on the common stock of the Electric Vehicle Co. caused a temporary rally among the stock gamblers, who did not stop to think how much easier it is to pay dividends than to earn them by the operation of Lead Cabs. Bluff, bravado and misrepresentation will postpone but cannot prevent the final day of reckoning. When the revelation does come the stuckholders will have ample proof of the truth of the statements of Prof. Elihu Thomson and Thomas A. Edison and the allegations of the editor of The Horseless Age. The Lead Cab is a predetermined failure.

On Monday, Dec. 18, all the Lead Cab stocks fell with a thud in Wall St. Electric Vehicle common declined to 50 bid, notwithstanding the recent 2 per cent. dividend; New York Electric Vehicle Transportation was quoted at 9 bid and New England at 6 bid. Electric Storage Battery common declined to 90 asked and no bids on the Philadelphia Stock Exchange, a loss of about 36 points in a little over two months. Lead Cab stocks are gradually finding their level. The next slump will be still more sensational.

Kent's Pacemaker.

The Colonial Automobile Co., 32 Hawley St., Boston, Mass., are soon to test a new steam vehicle of their manufacture called "Kent's Pacemaker." It has one steering wheel in front and three rear wheels, the central one of which is the drive wheel, the other two being so arranged that they can be raised and allow the vehicle to coast on two wheels like a bicycle.

The vehicle is provided with a vertical shell boiler very much like that of the locomobile and weighs about 500 lbs. The engines are of an improved pattern devised by A. W. Kent, of the company.

The Colonial Co. will also build one and two seated family carriages and delivery wagons.

A $10,000,000 Combination.

There is a project on foot to combine the American Motor Co., the Automobile Co. of America, Brewster & Co., the New York carriage builders, and the Cortlandt Wagon Co., of Cortlandt, N. Y., in one great automobile company, called the Consolidated Automobile Co., capital $10,000,000.

The Detroit Automobile Co. have issued a very artistic catalogue illustrating types of vehicles which they propose to manufacture.

American Entries for the International Cup.

At a meeting of the Automobile Club of America, held at the Waldorf-Astoria last Tuesday night, a letter was read from James Gordon Bennett, donor of the Bennett International Challenge Cup, calling attention to the fact that entries for next year's race must be made before Jan. 1 and expressing the hope that the American club would be represented in the first contest.

It was announced that Alexander Winton, of the Winton Motor Carriage Co., Cleveland, O., wished to enter a carriage. Several members spoke in favor of entering the race, while A. R. Shattuck, who has spent much time in France studying the motor question, advised caution on the ground that the French had had much experience in racing machines, and that the carriages they entered were built for speed only. On his motion it was decided to appoint a committee of three to examine the automobiles presented for entry by American manufacturers. If the carriages pass the committee and the owners are willing to post the $600 entry fee, the committee will complete the entry. If more than three carriages are entered trial races will be held to determine those best suited to represent the club.

John Brisben Walker, of the Mobile Co. of America, Tarrytown, N. Y., offered the club a country club house at Kingsland Point, north of Tarrytown, fully furnished, for the year 1900. The offer was gratefully accepted.

The by-laws were amended so as to permit of the election of 500 active members and 200 honorary members. There are 120 applications for membership on file.

President Clausen Defines Pleasure Vehicles.

There is more trouble between the automobilists and President Clausen, of the New York Park Board. Isaac L. Rice, formerly president of the Lead Cab Trust, and still heavily interested in its various schemes, secured a permit to use an electric automobile in the Park on Dec. 12. On Thursday, the 14th, he rode into the Park in an electric coach in charge of a uniformed motorman and filled with women and girls on pleasure bent. President Clausen himself happened to appear on the scene just as the policeman at the entrance was scanning the permit produced by the motorman, which bore the name of Isaac L. Rice. He allowed the coach to proceed on its way, but the word that President Clausen had held it up spread among the Park police, and the progress of the vehicle was so frequently interrupted by them that the merrymakers withdrew in disgust.

On Friday President Clausen revoked Mr. Rice's permit on the ground that it did not include cabs or coaches, as was expressly stipulated in permits subsequently granted. The vehicle in which Mr. Rice and his friends entered the park is not regarded by President Clausen as a pleasure carriage, because it is old-fashioned and lumbering. In all the permits issued so far, he further states, the intention was that they should be confined to the owners themselves and should not be transferable to uniformed motormen or others.

The permit of Jefferson Seligman was also revoked at the same time and for the same reason. In a letter to Mr. Rice President Clausen stated his reasons for revoking the permit, adding that under the present ruling open pleasure vehicles of the Stanhope style could alone be allowed to enter.

Mr. Rice replied at some length, protesting against the revocation and characterizing Mr. Clausen as a despot.

The Automobile Club will probably appeal to the courts to decide how far President Clausen may discriminate in issuing Park permits for pleasure vehicles.

Motor Livery at Pittsburg.

D. N. Seely, president of the Seely Mfg. Co., has organized a scheme to erect charging stations for electric automobiles throughout Pittsburg and Allegheny and organize a company to operate a general motor livery. A livery building is being erected at Baum and Beatty Sts. that will be capable of housing 40 to 50 automobiles. Over 180 ft. of plate glass will be used in the front, and it will be so arranged that automobiles can be taken in and out easily. It is the intention to have owners of automobiles keep their vehicles in the stable, and upon telephone call the automobiles will be taken to the owner's residence as liveried carriages now are. A gas engine and dynamo will be installed in the stable so as to charge all electric vehicles and gasoline vehicles will also be cared for as well.

Mr. Seely intends establishing a charging station at the city end of the Grant boulevard, at Grant St. and Seventh Ave., for the East End residents who desire to come into town on shopping expeditions on their automobiles. The vehicles will be recharged and kept there until the owners are ready to return home.

Speed Restrictions in Paris.

The New York Herald cable dispatches report that the Prefect of the Seine has signed the police order restricting the maximum speed of automobiles in the Bois de Boulogne to 12 kilometers (seven and a half miles) an hour. In narrow roads, crossing turns or in the neighborhood of gates the speed is to be diminished to the pace of a man walking.

In addition, autos are forbidden near the Pré Catelan or the Allée des Acacias between 1 in the afternoon and 7 in the evening.

A statue of Emil Levassor, one of the pioneer French inventors in the automobile line, and late partner in the house of Panhard & Levassor, is soon to be erected at the end of the Avenue de la Grande Armée at the edge of the Bois de Boulogne, where M. Levassor stopped his machine after the Paris-Bordeaux race. M. Levassor will be represented seated in his machine upon a triumphal arch.

Cycle and Automobile Show.

The Locomobile Co. of America will not exhibit at Madison Square Garden. The automobile exhibitors are the Indiana Bicycle Co., the Loomis Automobile Co., Foster & Co., Canda Mfg. Co., Riker Electric Vehicle Co., Duryea Motor Co. and the International Automobile & Vehicle Tire Co. In the accessories department are the Diamond Rubber Co., the Dixon Crucible Co., the American Roller Bearing Co. and the Gleason-Peters Air Pump Co.

LONDON NOTES.

London, Dec. 7.

MORE PUBLIC VEHICLES.

It is now proposed to start a public service of motor cars between Norwich and Beciles. Arrangements are also being made at Derby by a local company to run a service of motor cars. The cars will probably run to Ashborne, Alvaston and Old Normanton. A new company is likewise being formed in Dublin to run a service of motor cars along the North Wall and other places. There is also reported to be another scheme under consideration for running cars between Dublin and Enniskerry.

Quite a number of the London newspapers are now making use of motor vehicles in connection with their business. The News of the World has just purchased a motor delivery van, after having had the same in use on hire for several months. The Referee and the Weekly Dispatch are also making use of the automobile in the dispatch of special Sunday editions to the suburbs.

HORSELESS VEHICLES AS A SUBSTITUTE FOR RAILWAYS.

Now that the proposal for a light railway between Aberdeen and Echt has been abandoned, the establishment of a motor service which should cater for all neighboring districts not served by railways or other means of rapid communication is suggested. Dealing with the Aberdeen and Midmar route—17 miles in length—Mr. Murray, of Aberdeen, suggests the following as sufficient to deal with the traffic. One steam omnibus with a capacity for 24 passengers and 1,000 lbs. of luggage, and a maximum speed of 10 miles per hour; one steam dray of the capacity of 3 tons maximum and a speed of 7½ miles per hour; two light oil mail cars to carry mails and seven or eight passengers, with a maximum speed of 16 miles per hour.

A NEW ENEMY TO MOTOR CARS.

No great friendship is just now prevailing between rural district boards and automobilists in this country. The Yeovil Rural District Council is endeavoring to inflict some new regulations on owners of horseless vehicles and is circularizing similar bodies throughout the country on the subject. The alterations propose that the maximum speed be reduced from 12 to 10 miles an hour; that when within 100 yds. of an acute curve or junction of two roads, or of a horse on the highway, the speed shall not exceed 6 miles an hour, or, if the locomotive weighs more than 2 tons, 4 miles; that when about to overtake any beast of burden or vehicle audible, continuous warning of approach shall be given when within 100 yds., and that every light locomotive shall have a denoting mark or number so placed as to be at all times legible. Doubtless those who drew up these new suggestions regard themselves as great reformers and preservers of the highways and byways of their native land, but it is barely probable that their scheme will be carried through.

A SERIES OF PRIZE COMPETITIONS.

The Motor Car Club, which appears to be awakening from a long period of inactivity, has just announced a series of prize competitions. There are four different categories, in each of which first and second prizes of £100 and £50 respectively are offered. Competition No. 1 is for the best practical deodorizer suitable for a motor vehicle. It has been suggested that extinction of the smell from the exhaust is pos-

THE ALLARD "EXPRESS."

DENNIS DOCTOR'S CARRIAGE.

THE "LADY" VOITURETTE.

THE WEARWELL CARRIAGE.

NEW PARISIAN DAIMLER.

CANNSTATT DAIMLER AS OPEN VICTORIA.

CANNSTATT DAIMLER AS CLOSED CARRIAGE.

Some New Vehicles at the English Cycle Shows.

sible, and that whatever odor remains might be used as a disinfectant, rendered necessary in consequence of the use of horse and animal traffic.

Competition No. 2 is for the best practical automatic starter suitable for an oil motor vehicle. It must enable the motor to be automatically started from a stationary position at any time as easily as an electric or steam car is started.

Competition No. 3 is for the best practical automatic ignition suitable for a motor vehicle. The ignition must take place within the combustion chamber, and may be electric, but must be done entirely independent of high compression, batteries, accumulators, frictional contact, or any machinery operated by the engine, in such a manner as to cause perceptible loss of power.

Competion No. 4 is for the simplest and cheapest construction of motor vehicle of a feasible and practical kind, suitable to be manufactured in large quantities. All complicated gear must be avoided.

Full particulars of the competitions can be obtained from the secretary of the Motor Car Club, 40 Holborn Viaduct, E. C. One satisfactory feature of the affair is that the prize winners will retain their interest in the inventions, and if such assistance is desired the club will assist them to get their inventions properly patented throughout the world.

MOTOR VEHICLES FOR MUNICIPAL PURPOSES.

I have received a copy of a nine-page pamphlet prepared by the Surveyor of the Chelsea Vestry on the bids submitted for the supply of three motor vans. The following four tenders were received:

	Each van. £	For 3 vans. £
1. Coulthard & Co., of Preston	475	1,425
2. The Lancashire Steam Motor Co., of Leyland:		
For coke-fired motor	490	1,470
For oil-fired motor	510	1,530
3. E. H. Bayley & Co., of London, S. E.	650	1,950
4. The Steam Carriage & Wagon Co., of Chiswick (Thornycroft's)	700	*2,100

* Less 2½ per cent., with partial prepayment.

On comparing the estimates with his specification, T. W. E. Higgens, A.M.I.C.E., the Surveyor to the Vestry, remarks that no firm has strictly complied with it, and thus draws attention to the departures therefrom:

Compliance with the Locomotives on Highways Act.—Messrs. Coulthard's motor van is 2 tons 19 cwt., or just 1 cwt. under the weight allowed by the act. In full working order it weighs 3 tons 8 cwt. The Lancashire Motor Co. do not mention the weight of their vehicle. Messrs. Bayley & Co. say all motor vans at present in use exceed the statutory weight, it being impossible to construct one to carry a load of 4 tons of a tare weight less than 3 tons. They add that the Local Government Board are alive to this fact and do not therefore enforce the strict letter of the law. Messrs. Thornycroft state that their standard van (for which, apparently, they tender) does not of itself carry more than 3 tons, but would haul another 2 or 3 tons on a trailer. There is no doubt that the motor van industry is sorely crippled by the 3-ton limit. There is a consensus of opinion among engineers and manufacturers that this limit should not be insisted upon, and, I believe, Messrs. Bayley correctly interpret the attitude of the Local Government Board thereon. But, as regards the present tenders, Messrs. Coulthard & Co. undertake to comply with the 3-ton limit.

As regards the types of vans and speed, there does not appear to be anything to call attention to, except that Messrs. Bayley in their estimate of the cost of working provide for a lad to assist the driver; but this is, probably, only for long distance runs.

The Motive Power and Cost of Working.—All the firms tender for steam motors. Messrs. Coulthard prefer oil fuel; the other three prefer coke; but, as regards the guaranteed costs of working, no one gives any. They give estimates. Messrs. Coulthard, 2.88 pence per net-ton mile; the Lancashire Motor Co., 5.26 pence per vehicle mile. Messrs. Bayley say that the cost of fuel on their motor has worked out at one-twelfth of a penny per mile, and the cost complete at 0.8d. per net-ton mile, and Thornycroft's submit an estimate based on dust removal figures. Probably the meaning of all these differences is that no motor vans have been long enough in work for the makers to give guarantees upon past results.

The Height of Platform.—All comply with this except Messrs. Thornycroft, who say that the platform of their standard van slightly exceeds 3ft. 4 in. above the ground level.

Inspection.—Messrs. Bayley do not include this in the list of conditions to which they tender, but this is possibly an oversight.

Week's Trial.—Messrs. Coulthard and the Lancashire Motor Co. do not mention this, but they probably imply it. Messrs. Thornycroft agree to it, but Messrs. Bayley have again not included this clause as one to which they tender.

Payment.—Messrs. Coulthard ask for 90 per cent. within one month of approval, at their works. The Vestry, however, would require the delivery in Chelsea, and after delivery here I would approve them, if satisfactory. Neither the Lancashire Motor Co. nor Messrs. Bayley mention any different terms to those of the Vestry, Messrs. Thornycroft say one-third to be paid with the order and two-thirds on delivery. Of course, the Vestry could not consent to this.

Maintenance for Two Years.—Messrs. Coulthard ask £75 per van per year, but as they undertake for this to have a man continually available for the period of two years it might be possible to come to some terms whereby the man might be employed by the Vestry as a driver. The Lancashire Motor Co.'s price, 82 per cent., would amount to £58 16s. per van per year. Both these firms are prepared to guarantee these prices, but Messrs. Bayley estimate this cost at about £104 a year per van, and Messrs. Thornycroft are not prepared to give a definite undertaking at present, but their manager has since informed me that they would maintain the vans free for six months.

All agree to the conditions as to delivery. The bodies and encasing machinery are satisfactory in all cases.

Taking the specification as a whole, it is seen that Messrs. Coulthard & Co.'s tender shows the nearest compliance with the conditions under which the various firms were asked to submit estimates; but in considering any variation from the Vestry's conditions it should be borne in mind that there are two classes of variations: First, those which are caused by the van being constructed according to a maker's own pattern, toward which the Vestry might, if they think fit, allow a little latitude; second, variations from the specifications as to payment and approval, which should not be permitted, any tender being only accepted on condition that the Vestry's conditions in these respects should be strictly complied with.

It might be asked why some of the firms do not adhere more closely to the Vestry's conditions. The reason, I think, is that some firms have special types of vehicles—Messrs. Thornycroft, in particular, quote for their standard type of van—and it is much more satisfactory to a large firm, and in the end to those who buy their vehicles, that they should make all their vehicles of standard sizes and so be enabled to make all similar parts in all machines from the same patterns.

A GERMAN IDEA.

One of the novelties of the moment is the "Einrad," a single-seated carriage just brought out in Germany by Herr Hugo Mayer, of 54-56 Kurfürstendamm, Berlin, and of which I send you an illustration herewith. The object of the builder has been to produce a more comfortable machine than the now popular motor tricycle. The motor is of the type usually employed on the last-named machine. The gasoline tanks, etc., are carried on a tubular frame, which also forms the support

THE "EINRAD."

for the single front driving wheel, to which the engine is geared direct by spur wheels. The carriage portion of the machine consists of an ordinary trailer largely used in conjunction with motor tricycles in France, it being attached to the tractor by means of a "head" of the kind adopted in bicycles. The steering is controlled by a long bar on which all the control levers are mounted within easy reach of the driver.

THE "IVEL" MOTOR CARRIAGE.

Some two months ago I was privileged to inspect a new motor carriage in course of construction at the cycle manufactory of Dan Albone, Biggleswade, Bedfordshire. The new automobile is the outcome of practical experience Mr. Albone gained with a Benz carriage he owns. One of the special features is the under frame, which is constructed of steel tubing after the same style as that of the ordinary cycle, the arrangement of the tubes being such that the various strains to which the frame is exposed, both from the road vibration and that caused by the motor itself, are scientifically taken up, a double cantilever system being adopted. The frame is carried upon four spiral springs, those from the rear axle being contained in steel cylinders, which are raked slightly rearwards, so that the action of the springs may coincide with the lines of vibration from the wheels.

These cylinders serve another very important purpose. The sliding pistons upon which the springs act are sufficiently long to obtain an ample bearing surface in the cylinders, and thus prevent any movement of one spring taking place without a corresponding motion on the part of the other. The object of this arrangement is to secure that the chain wheels are always in positive alignment, so that the wear upon the chains and the friction set up are greatly reduced. The front axle springs are vertical, and are designed to allow the wheels to rise or fall to accommodate themselves to the inequalities of the roads traversed.

THE IVEL CARRIAGE.

The "body" of the carriage is mounted upon four C springs, the body, which is adapted for four persons, being entirely separate from the frame and working parts. The occupants are thus completely insulated from the vibration, not only of the road, but from that of the motor. Through the floor of the car, in the center, rises a tripod of three tubes, which carry a round fiber flat plate, upon the face of which are three small levers for the mixture, throttle valve, and electric ignition. Upon one of the uprights are the two levers for controlling the variable speed gears. The plate is slotted, and through it pass two long levers, one being that of the reversing gear and the other applying the tire brakes. This lever, when pushed forward, automatically opens a switch, thus breaking the electric circuit and so stopping the motor. The steering is controlled by means of a handle and a disk, after the manner adopted in the Benz carriage, but the standard is located well on the right hand side, the connection being made underneath the frame by means of a chain.

The motor is of the Benz horizontal type, of 3 h.p. with water jacket and electric ignition. It is located about the center of the frame. Its position is, however, exactly reverse to that adopted in the Benz—that is to say, the combustion chamber, not the fly wheel, is located at the rear of the frame, the motor thus running in the same direction as the car. Two speeds forward and one reverse motion are provided, the power being transmitted by straight belts from the motor shaft to an intermediary shaft behind the hind axle, and from the intermediary to the rear road wheels by duplicate chains.

Provision is made that the motor can be started from the driver's seat, it being possible to stop the car and start again at any time without having to get out of the vehicle. Both water and petroleum gauges are fixed in front of the driver, and everything is so placed that all the working parts can be easily got at without undue trouble, and any adjustments which may have to be made can be done in a few minutes. The bearings of the wheels are very large, ball bearings being employed wherever possible.

The main brakes are applied by the foot of the driver, and expand inside the drums formed by the chain wheels. These brakes, which take the form of double friction blocks, act both ways, so that, when on, the car cannot run backwards down hill. Both these brakes and those acting upon the tires are provided with a compensating device so that one side cannot be applied harder than the other. The gasoline tank is carried under the front seat, and contains about 9 gals., while the water tank is also large, enabling the carriage to run 100 miles without a fresh supply of water being required. Four cooling tubes with large mouths pass through the tank, and as the tank is well above the motor, no pumps are required to maintain the circulation. The chains and the motor are entirely inclosed—although in the illustration the casing is removed—so that the amount of cleaning required is reduced to a minimum. The accumulators and induction coil are carried on the carriage in a box placed at the rear, and all the necessary tools are also provided for in this arrangement.

The carriage has cycle type wheels and pneumatic tires. It weighs complete about 900 lbs. and is speeded up a maximum of from 16 to 17 miles per hour, Mr. Albone's object having been the production not of a racing car but of a comfortable, easy-running vehicle, capable of maintaining a fair speed.

"THE LADY," TWO-SEATED CAR.

Henry Cave, 38 Ford St., Coventry, is about to put on the market a new two-seated motor voiturette, which he has named "The Lady." The motor, of the 2¾ h.p. De Dion type, is inclosed in the front casing. The power is transmitted through a clutch and change speed gear of the sliding key type and a Stow flexible shaft to a reversing gear and speed reducing wheel situated on the back axle. The large spur wheel of the reducing gear is journaled on the frame carrying the differential gear, and drives the latter through springs which, it is claimed, greatly assist the starting and speed changing. Three speeds, the highest of which gives 16 miles per hour, are provided, while it is possible to reverse at any speed. A Longuemare carbureter is employed, and, with the oil tank, is situated in the motor casing, the latter being so arranged as to direct a maximum amount of air on to the cooling ribs of the motor. In order to facilitate the mounting and dismounting from the driving seat, the steering column is arranged on a transversely pivoted seating, so that it may be turned forward out of the way; a catch is employed to hold the column in its normal position for steering purposes. Advantage is also taken of the special arrangement of the steering column to form a motor starting device, so that the driver may start the motor when seated in the car. All the control handles, etc., are situated on the steering column, thus allowing the hands to be covered by a rug when driving. The total weight of the car is 550 lbs., the length being 7 ft. and the width 4 ft. 3 in. The wheels are of the cycle type, 28 in. diameter, and fitted with pneumatic tires.

Works are about to be established at Vorno, Italy, for the manufacture of motor vehicles. It is stated that the first vehicle to be produced will be a modification of the Bollée voiturette.

Mail Collection Test With Winton Wagon.

The Winton motor was subjected to an interesting test at Cleveland last week. Authority was granted by the postal authorities at Washington for the company to make a mail collection test in Cleveland. The weather was very "wintry." Snow was deep and in some place badly drifted, and during the entire time of the run there was a big snow storm in progress. The wagon made a collection trip which covered over 22 miles of paved and unpaved streets from 101 letter boxes and 25 package boxes. The time required for this collection by horses and wagon (under favorable conditions of weather) is 6 hours and 1 minute. Before starting the local postmaster said that on account of the severe weather his report to the Washington authorities would be favorable if the wagon succeeded in pulling through on the regular schedule time of 6 hours and 1 minute. The first box was opened at 12:22 p. m. and the last one at 2:49 p. m., making a total time of 2 hours and 27 minutes and thereby reducing the schedule time considerably over 50 per cent.

COLLECTING MAIL WITH WINTON MOTOR WAGON AT CLEVELAND, OHIO.

COMMUNICATIONS.

Arguments Against Small Front Wheels.

Port Carbon, Pa., Dec. 16.

Editor Horseless Age:

In looking over the various designs of automobiles, I notice it is the custom to make the front wheels smaller in diameter than the rear wheels. Is there any special reason for this difference in diameter, or has it been adopted because it is the custom in the construction of other vehicles?

The writer has had considerable experience in running the new vehicles, but so far has failed to notice any advantage in the small front wheels. On the other hand, there would be quite an advantage in the line of repairs and renewal of tires if both front and rear wheels were of the same diameter. I find one of the greatest sources of expense is the renewal of tires, and in order to be prepared for emergencies it is necessary to keep a pair of tires on hand. Now, if the wheels were all of the same diameter it would only be necessary to keep one tire on hand. I am also inclined to think that with front wheels the same diameter as rear wheels the vehicles would cross ditches and other obstructions much easier than when the small front wheels are used. I woudl like to see this matter discussed in your valuable journal by some of the experts in automobile construction and by drivers. AUTO.

Cuba Sets the Example for the United States.

Havana, Cuba, Dec. 11.

Editor Horseless Age:

According to my promise, I take pleasure in sending you these few lines to advise you of what we are doing.

We left New York with the Haynes-Apperson machines on the 26th ult. and reached here four days after. In a few days we had the machines passed by the customs authorities and then we began to lay out our suburban routes, running out in five directions from Havana—two along the coast and three inland to Guines, Bejucal and Guanajay. We are now fairly started and in working order, and I am pleased to state that the results thus far obtained are beyond my expectations. The inhabitants are wild at the advent of our machines, and at first we had considerable difficulty in moving about the city. The boys in the streets and others as well would climb on the machine until we had to call upon the police to clear the roads for us.

The first run which we made into the city of Guines was the cause of a celebration tendered us by the Mayor, who also gave us a dinner to celebrate the event. You must remember that these towns, while only a few miles from the city, have no railroad connection with it, and all the traffic is carried on by mule carts, and the mail coach takes the passengers at exorbitant rates. I explain this to show why the people of the different towns are wild over the establishment of our daily service, as it means a great deal to them.

We have now in working order four routes, over some of which we make three and four trips per day, over others two and one. We shall open new routes as fast as machines are received and men to work them are broken in. We have started also an express service, and are carrying the mails to several of the towns, and no doubt, as soon as the existing contracts expire, we shall obtain others.

The machines have worked very much better than we expected. We are now fixing up a shop so as to be prepared to do repairs when these become necessary.

On our first run of 72 miles we had the old chief Maximo Gomez, the head and brains that have guided the Cuban people for the past twenty years, and through whose efforts in behalf of liberty the country has made so many sacrifices, that now with our help she is beginning to enjoy the fruits and progress she justly deserves.

For your information I will say that the Havana Automobile Transfer Co. was organized under a charter granted by the State of New Jersey for the purpose of conducting a general transportation business in this island; that it has a capital stock of $500,000, and that all stock sold has been placed at par. We are here for legitimate business and not for stock speculation.

The officers are as follows: L. Carbajal, Marqués de Pinar del Rio, president; Luis S. Galban, of Galban & Co., vice-president; Ramon V. Williams, secretary and general manager; A. B. Mohler, superintendent of motive power.

The directors are: Marqués de Pinar del Rio and Luis S. Galban, of Havana; Hugh Kelly, 71 Wall St.; R. R. Conklin, director North American Trust Co., 100 Broadway, New York, and Charlton T. Lewis, director North American Trust Co., 32 Nassau St., New York.

Among the stockholders are several of the most prominent persons connected in the trade between the island and the United States, both here and in the States.

You will please note that this is the first American company now organized and actually working on long distance routes carrying both passengers, mail and express.

Yours truly,
RAMON V. WILLLIAMS.

The Ice is Already Broken.

Plymouth, Mass., Dec. 15.

Editor Horseless Age:

I inclose a clipping from the Boston Transcript of recent date. It tells why many of us do not have automobiles. We do not care to frighten people's horses, and more than all, we do not care to become involved in a suit for damages. If there were a national society of automobilists like the L. A. W. that would take care of all such suits, it would increase the rapidity of their introduction to a tremendous degree. As it is, we are only waiting for somebody else to break the ice.

Your truly,
JOHN J. SHAW.

[We refer our subscriber to the Automobile Club of America, Waldorf-Astoria, New York, as a protective society of this kind, and assure him that the damage suit is largely a bugaboo.—Ed.]

The clipping reads as follows:

Driving on the high road in the country in an automobile may not be altogether an agreeable experience. A friend of mine, who is a courteous gentleman, careful of the safety and feelings of others, has told me something of the experiences

he had the other day in driving his automobile between Boston and Providence. "As long," he says, "as I was within the city limits or in the larger suburbs, I bowled along pleasantly enough; but as soon as I got well out into the country, where none of the horses and few of the people have seen a horseless carriage, my troubles began. Every old Dobbin along the countryside evidenced a disposition, as soon as I came in sight, to get over the fence or the stone wall along the roadside, and take with him the vehicle to which he was attached. As long as these vehicles were driven by strong men and good drivers, as countrymen generally are, I did not greatly worry. In most such cases I simply stopped my automobile and let Dobbin go galloping and shying past. But when the carriages, as happens in a considerable proportion of cases, were driven by women, I felt much less easy in my mind. I have caused one runaway with my machine, and I am not anxious to cause another, especially in the case of carriages laden with women and children.

More Detail, Please.

New York, Nov. 30.

Editor Horseless Age:

Inclosed please find a rough sketch of a speed changing driver and reverse of vehicle. I have been thinking and trying to get the above with the least mechanism possible and still have something practical.

If you have time and if not taking up too much space in your valuable paper, will you kindly publish a few drawings of the above in simple form? I hope you will criticise the belt system and let me know if it is practical or not. W. F. Q.

The device shows a drum on crank shaft and open and crossed belts leading therefrom to tight and loose pulleys on a countershaft; on this last is a conical pulley and another belt from this to a similar pulley on rear axle, the scheme being to stop, reverse or go ahead with the first, and change the speed by moving the belt on the conical pulley.

If the belts maintain a constant tension, move when required quickly and easily, and, furthermore, need little mechanism, the arrangement submitted would be practical. The sketch provides for none of these, and we trust our friend will favor us with further details as to the necessary working parts he has contemplated. R. I. C.

"A Suggestion" Criticised.

New York, Dec. 18.

Editor Horseless Age:

In regard to the suggestion of a three-cylinder motor, in your issue of Dec. 13, would say that one built on the lines indicated, must have a number of good points; in my judgment, however, there will be one serious objection.

The probabilities are that the cylinder, or cylinders, below the center line will get an excess of lubricating oil, which will inevitably cause trouble. Even where the cylinders are level any excess of oil will work back into the compression space, where it will cause smoking and coating of the ignition points.

To overcome this objection the motor would have to be placed on its side—that is, with the fly wheel placed horizontally either above or below the crank case. In the latter case the valves and gears for actuating same would be placed on the top, where they can easily be got at.

A four-cycle motor would have to be designed to run in either one of two ways: One way the explosions following each other in the three cylinders in the direction of rotation of the shaft, will give three impulses during one revolution and none during the next; the other way the explosions following each other in the opposite direction, will give an impulse every two-thirds of a revolution, the impulses following each other in continuous and regular rythmical sucession. The latter should give satisfactory results. H. W. S.

What Mixture?

South Orange, N. J., Nov. 27.

Editor Horseless Age:

Can you tell me through the columns of your paper what mixture of air and gasoline or gasoline gas will produce the best results when ignited in an engine cylinder?

At what period of the stroke should ignition take place? M.

1. A brief attempt to answer would be productive of misunderstanding. You will find the question of the explosive qualities of various mixtures of gasoline and air discussed at some length in Prof. Redwood's work on "Petroleum."

2. Note page 14, Nov. 15, 1899. We may add that when starting a motor with considerable lead there is danger of a back explosion; some inventors avoid this difficulty by a device for changing the ignition point temporarily. The engine used on the Georges Richard machine is of this type. R. I. C.

A Cheap Muffler.

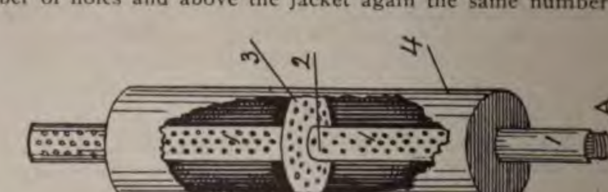
Cassville, Wis., Dec. 10.

Editor Horseless Age:

I have seen so many inquiries in your valuable journal in regard to mufflers for gasoline engines that I am in hopes a description of the one I am using may be of general interest. It cost 35 cents to make, weighs about 20 oz., has no back pressure that I can discover, can be made of any shape or size, placed anywhere desired, and after passing through the exhaust is cool.

I had mine made by the local tinsmith, and it muffles the sound so that a 2 h.p. engine cannot be heard more than a few yards—in fact, the clack of the valves is louder than the exhaust.

It is made of common stove pipe. A is a gas pipe nipple screwed on the exhaust of the engine, I is a sheet iron pipe that slips on the nipple and is held by a rivet, 2 is a solid diaphragm in the pipe I, below which are punched enough ⅛-in. holes to equal the area of the exhaust port, 4 is a jacket around the pipe I, with a diaphragm, 3, perforated with a like number of holes above the diaphragm. The pipe I has the same number of holes and above the jacket again the same number of



perforations. The pipe I is completed by a solid cap on top. The radiation of heat from the jacket 4 creates a partial vacuum sufficient to counteract the back pressure caused by splitting the exhaust to pass through the first series of holes.

It can be made double and hot air drawn from between the jackets to the inlet part; it can be made flat and placed under the gasoline tank or used as a foot warmer in cold weather.

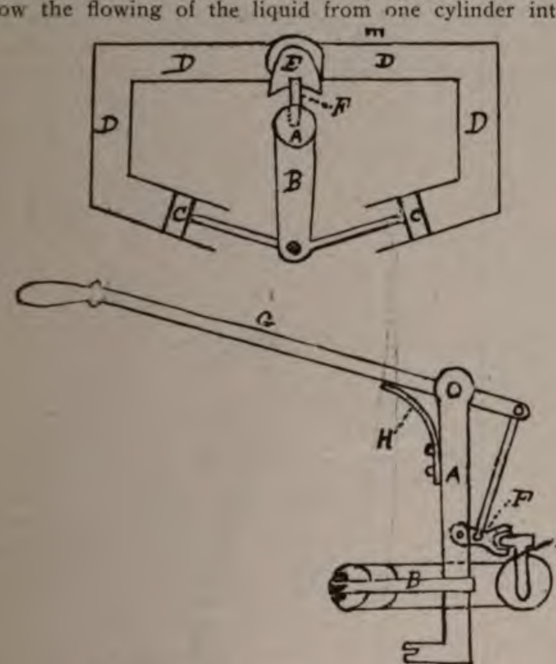
W. P. HARTFORD.

Hydraulic Steering Device.

Rochester, N. H., Nov. 30.

Editor Horseless Age:

Inclosed I send you a device for steering automobiles that you will treat with all the indulgence due to a person that is not versed in mechanics. As you can see by the accompanying design, the whole affair consists of two pistons playing in two cylinders full of glycerine. When the communication is interrupted between the two cylinders it will be impossible to turn the steering handle and the vehicle will move always in the same direction in spite of the irregularities of the road. If you depress the handle G and thereby open the valve E you allow the flowing of the liquid from one cylinder into the other more or less rapidly, according to the degree of opening of the valve E, and consequently of steering the vehicle in any direction. Let us suppose that while steering the handle would be jerked off the hand of the driver; the spring H would push up the handle, close the valve E and prevent any further turning of the wheels. Yours truly,



ERNEST DUVAL, M.D.

A—Steering post carrying an arm, B, connected with two pistons, C, moving in two cylinders freely communicating with the tubes D, filled with glycerine.

E—Valve interrupting the communication between the two halves of the tube D.

F—Forked lever operating the valve E.

G—Steering handle hinged on the steering post.

H—Spring supporting the steering handle and thereby closing the valve E.

I—Arm connected with the hubs.

There is a familiar look about this interesting device, but we cannot just now remember fully. At least one hydraulic arrangement of a similar character has been shown in The Horseless Age. R. I. C.

MINOR MENTION.

The Elmore Bicycle Co., Clyde, O., will manufacture automobiles.

The Druid Hill Park Board, Baltimore, Md., is in favor of admitting all kinds of motor carriages to the park.

The great beef packing house of Swift & Co., St. Joseph, Mo., have introduced an electric delivery wagon.

The Eisenhuth Horseless Vehicle Co., of New York, is about to increase its capital stock from $1,000,000 to $10,000,000.

The New Haven Electric Cab Co., has been organized with $60,000 capital to introduce Lead Cabs in New Haven, Conn.

The New Jersey Electric Vehicle Transportation Co. is looking for a site for a central Lead Cab station in Newark, N. J.

T. B. Lasher, of Bridgeport, Conn., has obtained a license to operate motor coaches seating 15 persons in the city of New Haven, Conn.

The subject for discussion at the meeting of the Electrical Section of the Franklin Institute, to be held on Friday evening, Dec. 22, will be "Automobiles."

The Western Automobile Co., capital $6,000,000. The incorporators are H. M. Martin, A. H. Chetselain, John H. Curtis and David H. Roolin, of Camden, N. J.

A new Maine corporation is the Rotary Motor Vehicle Co.; capital, $400,000; incorporators, E. F. Porter and W. R. Whiting, of Boston, and N. S. H. Sanders, of Danvers, Mass.

Among recent New Jersey corporations is the Western Automobile Co., capital $6,000,000. The incorporators are H. M. Martin, A. H. Chetselain, John H. Curtis and David H. Roolin, of Camden, N. J.

Last Saturday night fire burnt out the upper floors of the factory of the Electric Vehicle Co., 211-219 East Forty-second St., New York, consuming a number of Lead Cabs and involving a loss of $150,000, covered by insurance.

Owing to increasing business, the Boston Gear Works have removed from 31 Hartford St. to the corner of Purchase and Pearl Sts., where they occupy an entire floor and have increased facilities for the production of their superior special steel motor vehicle chain, compensating gears, etc.

Walter Hay has sold out to his partner his interest in the Hay & Hotchkiss Co., New Haven, Conn., and is desirous of placing his valuable experience in the designing of motor vehicles at the disposal of capitalists wishing to engage in the business. He may be addressed in the care of The Horseless Age.

The Dayton Electrical Mfg. Co., Dayton, O., are putting on the market three different types of igniting apparatus for gas and gasoline engines. That for small motors consists of two semi-dry starting batteries, a dynamo, spark coil and switchboard, all properly wired so that any one can connect it up to an engine.

Balancing—A Suggestion.

By E. J. Stoddard and C. E. Wisner.

Minerva came into existence perfect and complete, but her children need maturing. The first embodiment of an idea is complex and inapt and development is in the line of simplification. It is well to balance a gas engine used upon a vehicle. Can it be done without too much complication?

We send you herewith an illustrative drawing in the nature of a suggestion.

In a gas engine the impulses are violent. We should therefore cushion them. The resilient member between the power and its work is a tried and approved expedient. We may try it with confidence.

In the drawing A is a gear wheel with exterior and interior teeth. B and C are small gear wheels meshing respectively with interior and exterior teeth of the wheel A. The wheel A carries the driving shaft with it. D is the double cylinder of the engine having the combustion chamber in common. The gear wheels B and C are on the engine shafts, as are also the two fly wheels E and F.

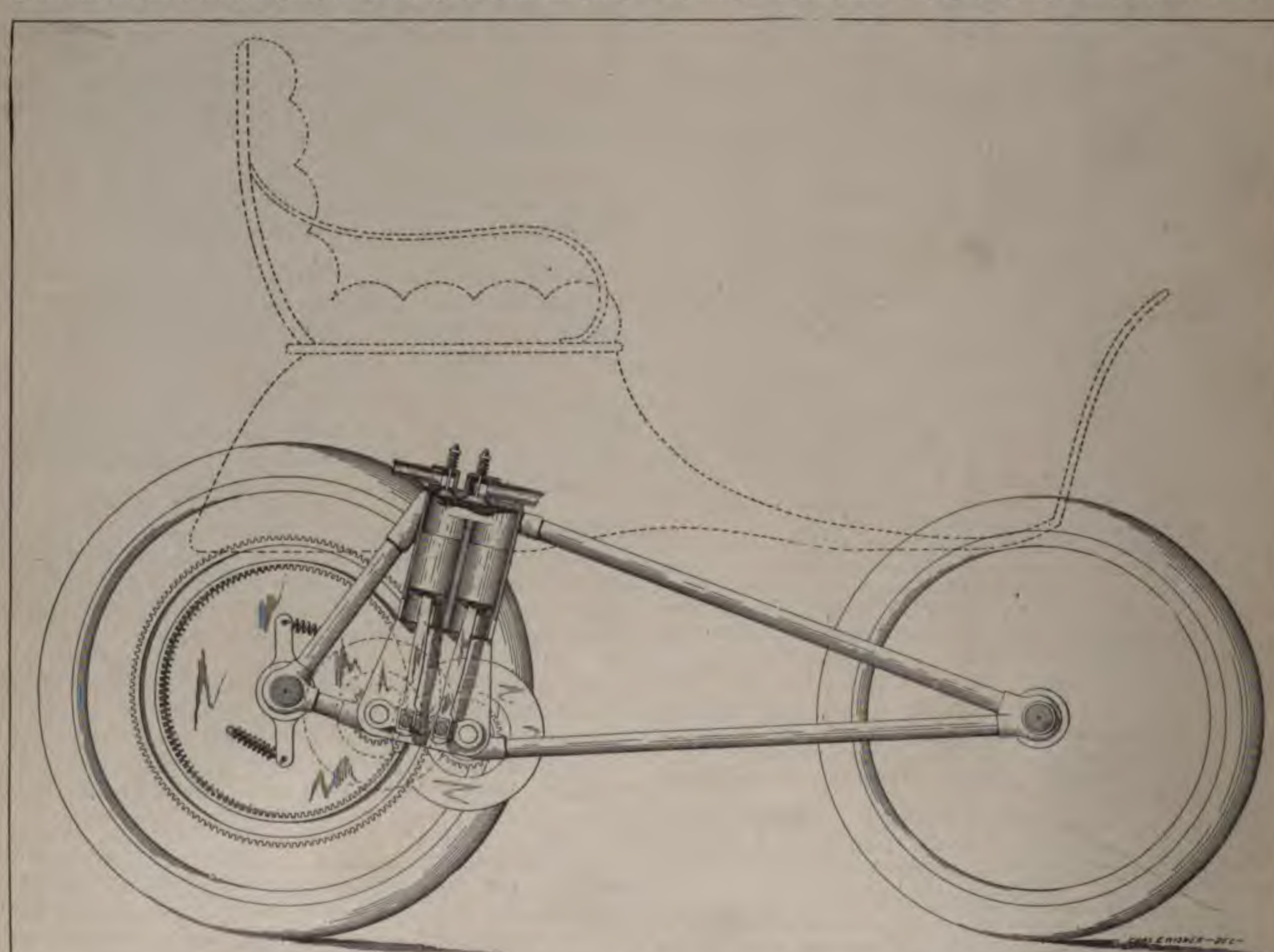
The shafts E and F turn in opposite directions, as indicated by the arrows, and the two pistons are always held in the same relative positions by the said gear wheels meshing with the wheels A. The engine is practically balanced.

To avoid complications we dispense with the change speed gearing and govern the engine by altering the tension of the spring on the inlet valve. It will be noticed that the engine forms the strut for the frame, and that the structure will be rigid.

The pressure of the gases upon the piston is largely taken off from the shafts and comes directly upon the driving wheel A, thus avoiding friction to a large extent. The reaction of the spring S has a tendency to raise up the forward wheels, thus making them run easier, and to add the weight taken off from the front wheels to the weight on the rear wheels, thus making them hold better.

Of course we do not claim that this drawing illustrates all the practical details. We present it only as a suggestion. The parts, however, generally have their proper relative sizes.

A lady with her daughter seated in a Decauville voiturette was trying to start the motor. She turned the fly wheel for some time in the presence of a large crowd of interested spectators, and remarked impatiently to her companion, "I can't get an explosion." A boy in the crowd, hearing this, exclaimed: "Stand back! There is going to be an explosion!"



BALANCING—A SUGGESTION. BY E. J. STODDARD AND C. E. WISNER.

OUR FOREIGN EXCHANGES.

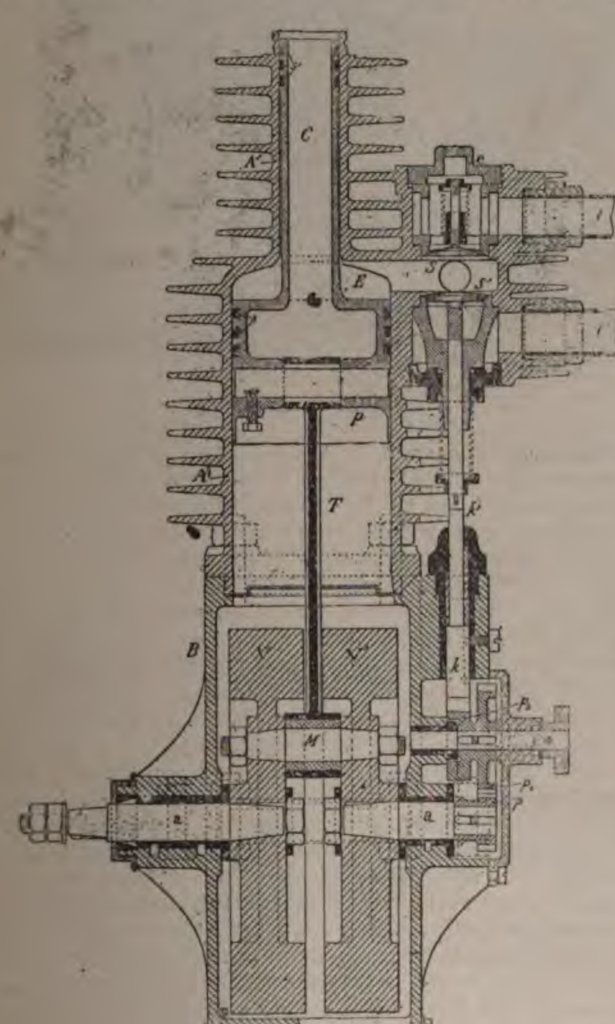
The Minerva Motor.

The motor trials at Aubervilliers under the patronage of La Locomotion Automobile have put in evidence the curious and interesting motor submitted by La Minerve Société, the first of the series that company has under construction.

The original feature of this motor consists in an interior cooling, which, in combination with the cooling influence of the ordinary flanges, prevents overheating in much more certain manner than when effected by simple cylinder flanges.

As may be seen in the figure, the piston P is, at its upper end, extended by C, forming a smaller second piston, which slides in the cylinder A', equally less than the cylinder A.

In this manner the interior of the piston P, and necessarily the inside of the crank case B, is in constant communication with the exterior air, which is drawn in and exhausted through the passage C, by the movement of the piston. This arrangement guarantees a perfect cooling system and permits giving this motor a high compression without heating. These motors



THE MINERVA MOTOR

have been able to sustain compressions of 4 kg. 500, the maximum temperature, under a lengthy application of the brake, not exceeding 280 deg. Cent.

When the motor is applied to a vehicle, the cooling by the circulation of the air among the flanges, added to the interior cooling action, will prevent the temperature being raised above 150 deg., even after several hours' work.

The other details of La Minerve motor are alike to those of similar engines. They have been the subject of profound study and all parts liable to wear have been furnished in tempered steel.

The tightness of the piston is assured by the segments s and s', fitted to the large and small piston, as in other ordinary motors. The connecting rod T turns the disk cranks V by the pin M, V V are keyed on a a and inclosed in the crank case B, crank shaft a carries at one end the pinion p, which gears with the pinions p^1 p^2. These last work the cam k, which controls the rod k' of the exhaust valve S'. The admission valve S works automatically and the valve cases are easily reached by way of the threaded cap e. The ignition is electrical.

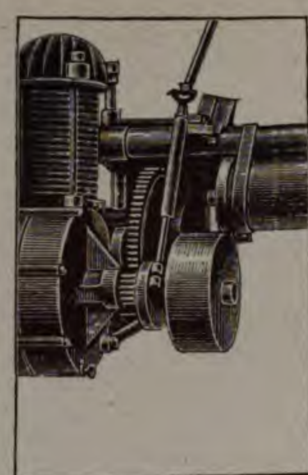
We understand that the motor, type M. A., is supplied for an effective strength of 120 kilogrammeters, 1¾ e.h.p.

So far we have followed our contemporary, La Locomotion Automobile, and would call attention to such peculiarities of the motor as seem worth additional mention.

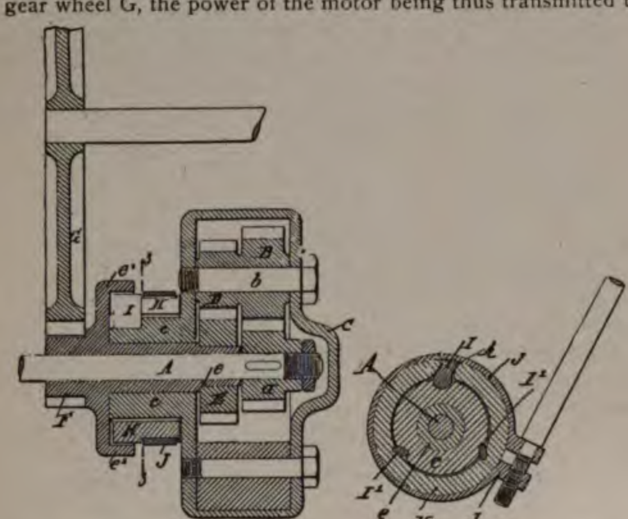
We do not call to mind an exact counterpart of this peculiar design, but with a view to getting a double acting explosive engine the experiment has been tried of enlarging the piston rod and having an opening in the center of rod for the free circulation of air along the bore, for the same purpose sought by the designer of the Minerve motor. This enlargement cuts down the effective piston area and we shall await the forthcoming tests with some curiosity to learn whether the increased cooling efficiency is or is not balanced by the decreased area of piston. The expense in fitting up the additional piston and cylinder must also come in for consideration, as well as the subsequent maintenance and the disadvantage of increased weight. The inclosed gears, and having the valves on a common axis, so that they can be bored by a single setting in position, seem as commendable as the nuts in crank case are otherwise.

The "L. B." Two-Speed Gear.

The "L. B" is the name of a new two-speed gear for motor tricycles and light motor vehicles which has lately been introduced by M. Alphonse Eldin, of 21 Place Bellecour, Lyons, France. Referring to the sectional illustration herewith it will be seen that the motor shaft A is extended and at its end carries a pinion, a, in mesh with a pinion, B, which with the wheel D rotates on a small shaft, b, supported in the case C. The wheel D gears with a pinion, E, keyed on a hollow shaft, e, surrounding the motor shaft. At the other end of e is a pinion, F, meshing with the large gear wheel of the tricycle. The case C is mounted loosely on the shaft by means of a sleeve, c, in such a way that it is free to rotate. Around the sleeve c a ring of expanding metal, H, is arranged, the inner arc of which is opposite to the sleeve c, while the outer face can be brought in contact with a disk, e', formed on the hollow shaft e. This ring is broken at h to receive a piece, I, the lower portion of which rests in a cavity formed in the sleeve c. The ring H, by reason of its elasticity, normally tends to



bind on the disk e'. A band brake, J, is provided around one part of the ring, by means of which the latter can be made to bind on the sleeve c. The action of the gear is described as follows: When the band brake J is applied and the ring H is thus in rigid contact with the sleeve c, the whole of the gear is firmly held. Under these conditions the pinion a drives the wheel B and the group B D, the pinion D actuates the pinion E and consequently the sleeve e, the pinion F and the gear wheel G, the power of the motor being thus transmitted to



the latter at a reduced speed, according to the ratio of the pinions. To permit the motor to drive the machine at its normal speed, the band brake J is released, the ring H regains its normal diameter and comes into contact with the disk e'. As a result of the friction between the disk and the ring the latter tends to rotate in the same direction as the disk; the piece I alters its position, the tendency being for it to open to a larger extent, the break in the ring H forcing the outer surface of the latter on to the disk until perfect contact is made between the two. The case C, which is oil-containing, is thus brought into rigid connection with the disk e' and the whole gear and case are driven at the same speed as the motor shaft. All that is necessary to change to the low gear is to apply the band brake J, the latter being controlled by a handle fixed in a convenient position on the frame of the machine. The makers claim that the device is most effective in operation and works without shock or noise.

THE TOWARD STEAM FREIGHT WAGON.

T. Toward & Co., of St. Lawrence Works, Newcastle-on-Tyne, have recently built a steam wagon for a firm of mine owners in Yorkshire. From the illustration of the vehicle (Fig. 1) it will be seen that the wagon is mounted on a strong steel frame with horn plates (locomotive style). This in turn is, in the case of the hind end, suspended by spiral springs on axle boxes, and a steel shaft, on which the steel road driving wheels are mounted, the front end is supported on a fore carriage with laminated springs and turn plate on a steel shaft, and steel front wheels with special auxiliary iron tires. The steering is controlled by a hand wheel, worm wheel, and chains on the traction engine principle. The coup is built of steel throughout, with a swinging door behind, and, after being hinged to the underframe, is fitted with mechanical tipping gear for discharging its load. The vehicle is fitted with two

TOWARD STEAM WAGON.

independent brakes and band brake on the intermediate shaft actuated by a pedal and one pair of band brakes on the driving wheels worked by a lever. The propelling machinery consists of a pair of compound reversing horizontal engines, capable of developing 25 i.h.p., placed directly below the under frame and geared with two speeds (8 and 4 miles per hour), and differential gear to an intermediate shaft, which in its turn is geared direct with pinions into an intermediate spur wheel on each driving wheel and entirely cased in this, dispensing with the usual chains and sprocket wheels.

Steam is supplied at 200 lbs. per square inch by a Toward high pressure water tube boiler described below. It is placed right in front of the driver, as also are the manipulating levers and steering gear. The feed tank, which carries enough water for a 12-mile journey, is fitted below the under frame, and the feed pump is arranged so that the water can be pumped into the boiler by the main engine while the vehicle is standing. The exhaust steam passes through a filter tank, and then exhausts into the chimney, there being no visible steam while running. An end view and longitudinal sectional elevation of the Toward light high pressure boiler, the claims for which are high generative efficiency, lightness and compactness, and a high factor of safety, are shown in Figs. 2 and 3. The boiler is of simple construction, and consists essentially of two tube plates

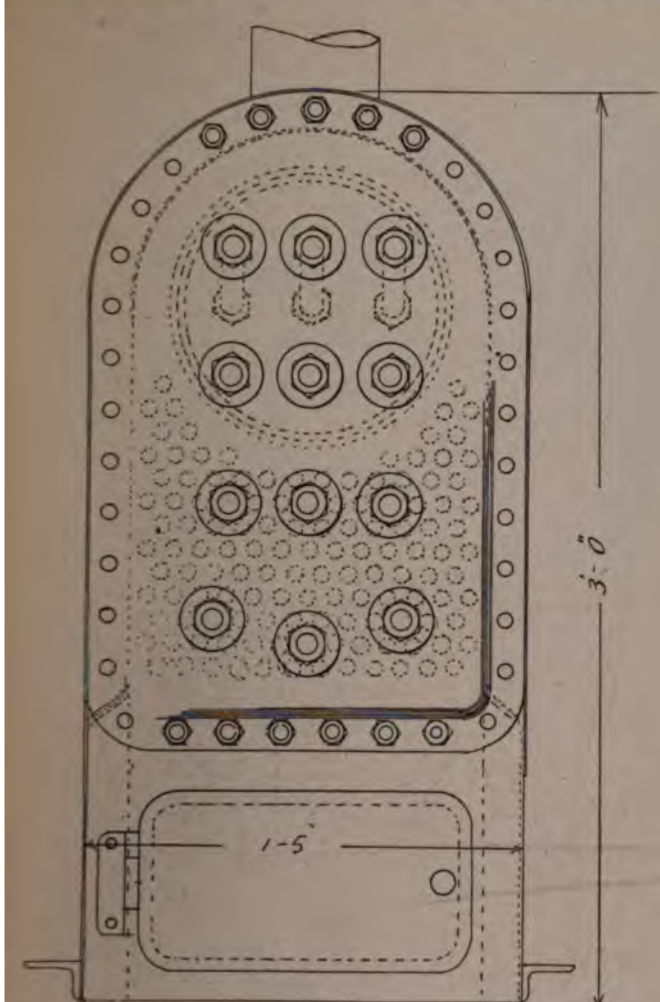


FIG. 2.

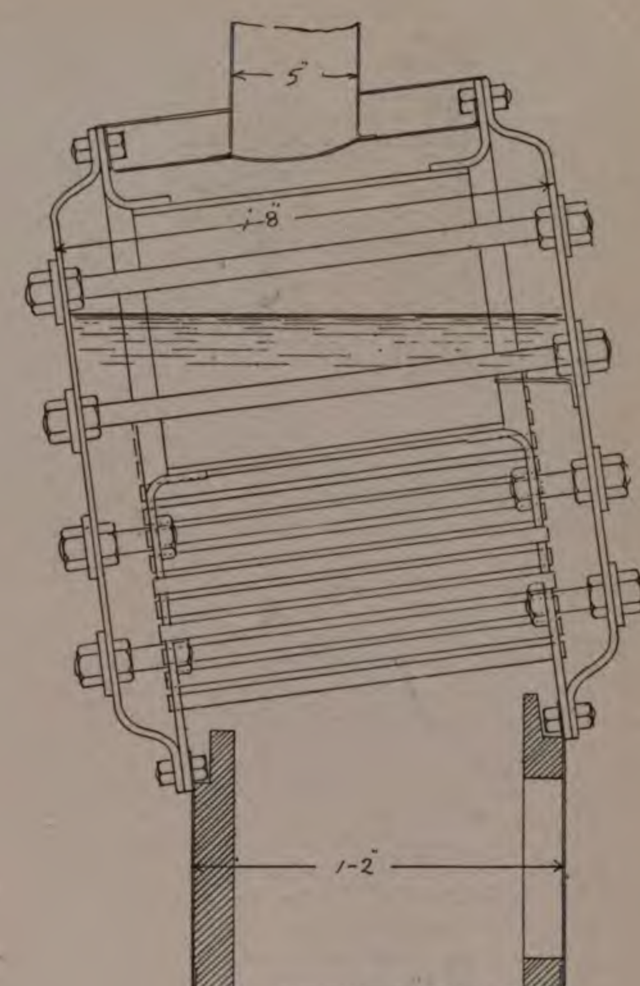


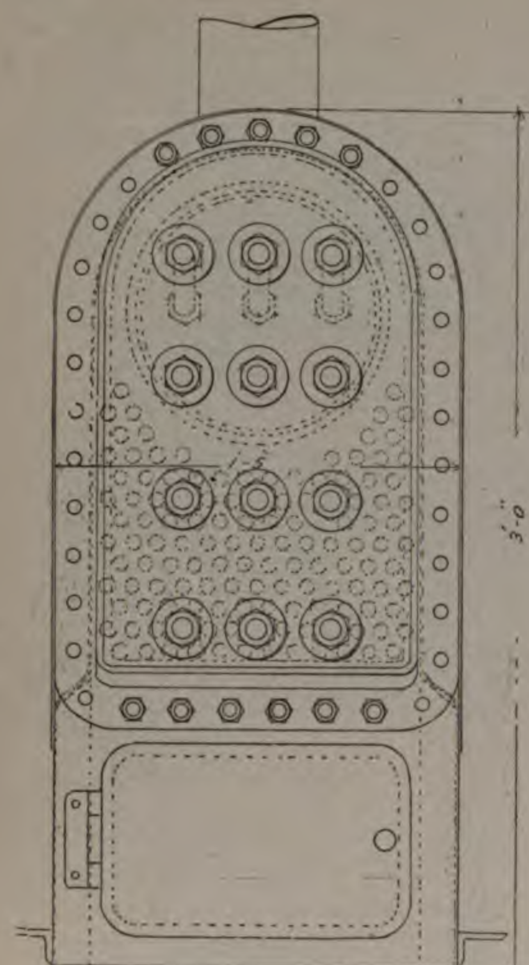
FIG. 3.

inclined sufficiently to promote a rapid circulation in a definite direction. These are connected at their upper portion by a single large tube, which acts as a steam drum, and at their lower portion by water tubes and by the requisite stay tubes, the water level extending up into the drum. Embossed steel plate covers or end doors suitably stayed form the water pockets, into which the tubes open. By the removal of the end covers and the cleaning doors, on the side of the boiler casing, easy access is gained to all the tubes and drum, inside and out, for cleaning when necessary or for repairs. The top and sides of the boiler are inclosed by a casing of light steel, which extends below the tube plates, and serves to form the furnace, and to support the grate. The boiler is generally lined with fire-brick, though where the greatest lightness attainable is not aimed at, water spaces may be used all around the furnace. That the boiler is a quick steamer is shown by the following particulars of a test made with a boiler of this type, measuring only 2 ft. 2 in. by 1 ft. 10 in., by 4 ft. high, including ash pit, and fitted with 1-in. steel tubes: Lighted up coke fire, 1:18; water boiling from all cold, 1:32; 10 lbs. of stem, 1:36; 20 lbs. of steam, 1:38; 50 lbs. of steam, 1:40; 100 lbs. of steam, 1:41; 150 lbs. of steam, 1:41½; 180 lbs. of steam, safety valve lifted, 1:42; trial began with strong blast in chimney, 1:46; finished, 2:46. An "evaporation test" to determine the capacity of the boiler followed. Cold water to the amount of 615 lbs. was evaporated in an hour at a pressure of 190 lbs. per square inch above atmospheric pressure, the steam being perfectly dry.

In a modified form of the boiler (Figs. 4 and 5) the back water pocket is dispensed with, and in its place the back furnace casing plate is perforated to receive and support the back ends of the tubes (which are closed and fitted with screw plugs), which project through it sufficiently to allow for any collection of deposit. In this way the boiler can be worked for long periods without fear of the tube ends being burnt. The front water pocket is somewhat enlarged, the steam drum being retained, while in certain circumstances circulating tubes are fitted from the front of the reservoir. It is also possible to dispense with the steam drum, and somewhat further enlarge the front pocket, thus giving a further reduction in weight. Under all circumstances, however, the boilers are substantially designed to work continuously under heavy work without giving trouble.

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of THE HORSELESS AGE, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.



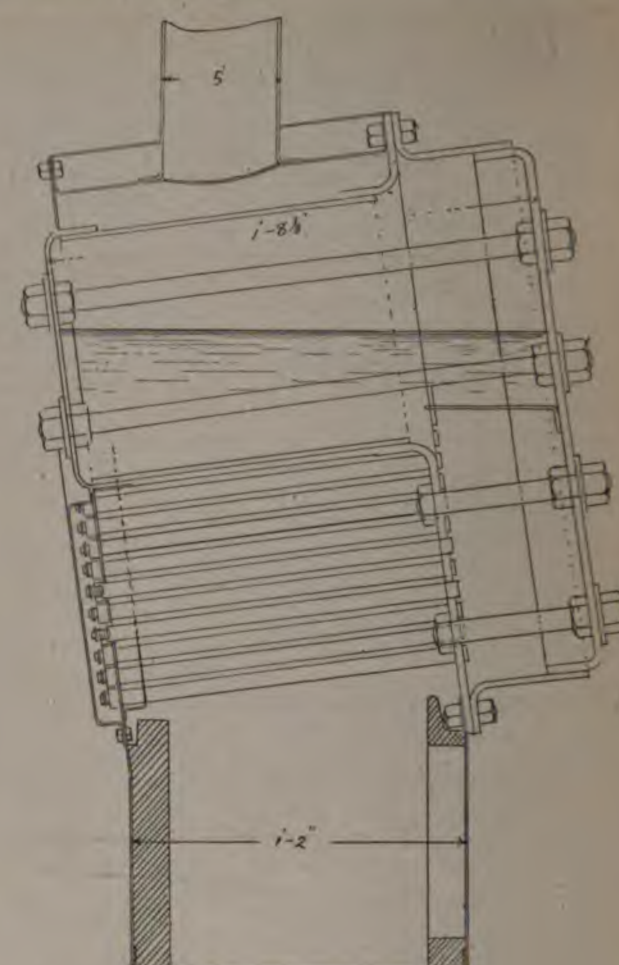


FIG. 4. MODIFIED PLAN OF TOWARD BOILER. FIG. 5.

CULASSE BUCHET.

The Culasse Buchet.

In our issue of Oct. 14 we published a line drawing and description of the Culasse Buchet, or new combustion chamber head, which has been got out for increasing the power of De Dion motors without overheating. The illustration herewith will give an idea of its general appearance. It will be seen that the exhaust and inlet valves are right on the top of the combustion chamber, in the direct line of the travel of the piston. The exhaust valve is timed by a cam and lifting gear, worked from the motor shaft. The gas is admitted into the chamber right above the piston, and the idea is that the explosion takes place directly downward, and not from the side, as in the ordinary side combustion chambers. Not only so, the combustion chamber, it is claimed, is much more perfectly cleared at each exhaust stroke, as the products of combustion are less likely to hang about the combustion chamber. We are unable to say whether the claim of the manufacturers, Messrs. Buchet et Cie., can be substantiated, but they guarantee 30 per cent. more power by their Culasse. We understand that the United Motor Industries, of 64 and 65 Holborn Viaduct, have the sole British agency for the fitting, and that they are having it tested by two or three well known motor tricyclists in this country. The result of their tests will no doubt be looked forward to with interest.—The Autocar.

MOTOR VEHICLE PATENTS

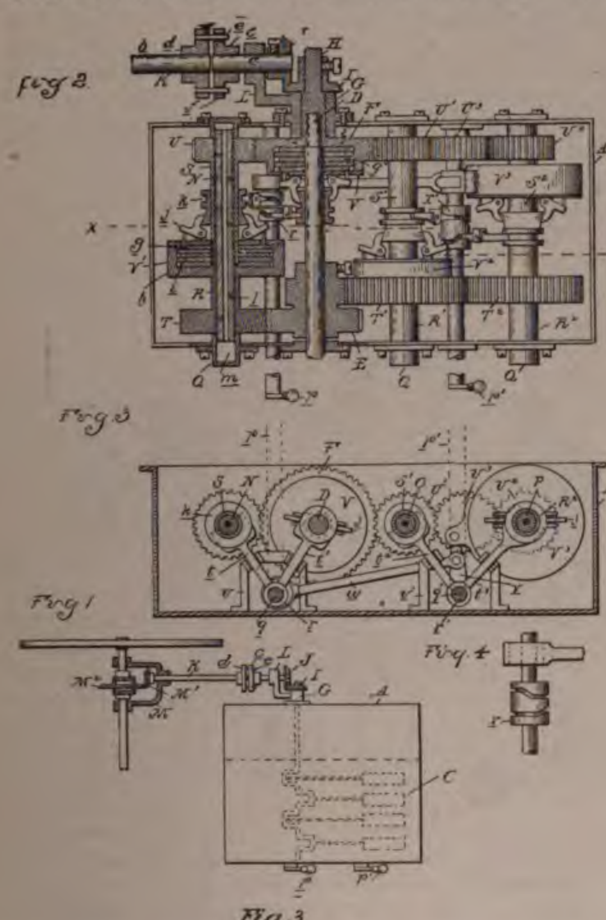
of the world

UNITED STATES PATENTS.

No. 638,029—Nov. 28, 1899—Motor Vehicle.—Barton L. Peck, Detroit, Mich.

Fig. 1 is a diagram plan. Fig. 2 is an enlarged sectional plan of gearing. Fig. 3 is a section on line x x, Fig. 2. Fig 4 is a detail view of the cam for operating clutch.

The device is specially contrived to provide a more or less flexible connection between the drive shaft and the driven wheels The inventor claims that with this construction as described it will be readily understood that whenever motion is imparted to the shaft D all the gears in the train meshing with the gear wheel E will be driven, but the gears in the train corrseponding to the gear wheel F will remain stationary unless one of the clutches is operated. When one of these clutches, such as V, is operated, motion will be imparted there through to the gear wheel F and also to the other gears of the



train. These other gears, however, run loosely upon their respective shafts as idlers, with the exception of the particular one through which the driving is effected. Thus when the clutch V is operated the gear F will be driven in the same direction as the shaft D. When the clutch V' is used the gear F will also be driven in the same direction, but at a slower speed. Again, when the clutch V^2 is operated the gear F will be driven in the same direction at a still slower speed. When the clutch V^3 is operated, the direction of movement of the gear F wil be reversed, and this is accomplished by placing an intermediate gear, U^4, between the gear wheels U' U^5, which will reverse the direction of the latter.

The shafts N, O and P are preferably hollow and are provided with a series of apertures, l, while at the ends of said shafts are formed the chambers m in the bearings Q, which serve as oil pockets, from which the lubricant is distributed through the hollow shafts and apertures l. This arrangement perfectly lubricates the bearings for the sleeves upon said shafts, and as the latter completely cover the shaft dust and dirt will be effectually excluded from the bearings.

The clutches on the different shafts are preferably staggered in relation to each other, so as to facilitate their connections with the operating levers. The clutch V is also preferably located within the gear wheel F, which is recessed to receive the friction disks g i.

The levers for operating the clutches may be arranged in any suitable way; but in the drawings are shown two levers, p and p', secured respectively to the rock shafts q and q', journaled in the casing. Mounted upon these rock shafts are heads, r and r', which are provided with cam slots with which the ends of the levers t, t', t^2 and t^3 engage. These levers correspond in number to the clutches, and they are fulcrumed in suitable standards, such as u and u', while their opposite ends are bifurcated to engage respectively with the sleeves k of the different clutches.

v is a rock arm loosely pivoted on the shaft q' and carrying at its free end a brake shoe adapted to engage with the periphery of the casing of the clutch V^3.

w is a rod pivotally connected at one end to the arm v and at its opposite end connected to an eccentric on the shaft q.

The parts above described are so arranged and the cam slots in the heads r and r' are so formed that by throwing the levers p and p' to various points any one of the clutches may be operated or all may be released, while by operating the lever p in the reverse direction the brake may be applied. Moreover, the arrangement is such that by throwing the handles of either of said levers p and p' forward—that is, from their central position in the direction of forward movement of the vehicle—the proper clutches will be operated to drive the vehicle forward, while by throwing said levers backward one of them (the lever p) will reverse the direction of the vehicle and the other one (the lever p') will apply the brake.

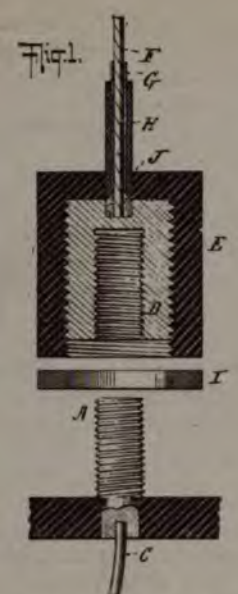
Four claims. Application filed May 8, 1899.

No. 638,141—Nov. 28, 1899—Hansom Cabs.—Geo. J. Quinsler, Brookline, and Geo. W. McNear, Auburndale, Mass. Two claims. Application filed Aug. 18, 1899.

No. 638,230—Dec. 5, 1899—Binding Post and Connection for Electrical Apparatus.—Alex. Fischer, New York, assignor to A. R. Shattuck, of same place.

The invention has for its object to provide a means for electrically connecting a conducting wire to any electrical appliance—such, for example, as an induction coil—in such a manner as that the connection will be completely impervious to moisture, either at the joint or elsewhere.

The invention consists, first, in the construction of the connecting device which is secured to the conducting wire, and,



second, in the combination of that device with a casing of insulating and impervious material inclosing the appliance in such a way as to form a moisture tight joint.

In the accompanying drawing Fig. 1 is an enlarged cross sectional view of my improved binding post and connection.

A is a rod of metal screw threaded on its exterior and secured in any suitable way in the side of the inclosing case, which is of non-conducting material. The post A connects with the electrical appliance by means of the wire C. D is a tubular cylinder of metal closed at one end and threaded both inside and outside. The external thread of cylinder D engages with the internal thread of an inclosing cylinder E, which is made of hard rubber or other waterproof insulating material. Cylinder E is closed at one end and is provided at such closed end with a small opening through which passes the conducting wire F. This wire enters a recess in the closed end of cylinder D and is secured therein by solder or other suitable means. Surrounding wire F may be a coating of cotton, G, and outside of said coating is a covering, H, of soft rubber, which is secured by cement at J within the opening in cylinder E, through which it passes. The post A is received in the threaded bore of cylinder D, which is screwed down upon said post. Between the lower edge of cylinder D and the side of the case B is interposed a soft rubber washer, I. This construction obtains a perfectly water tight connection. The wire C, being covered by rubber, is of course impervious to moisture. The joint at J between the rubber covering and the rubber cylinder E is also tight. The rubber cylinder E completely protects the inner metal cylinder D, and it will be noticed that the said cylinder D does not completely fill the inclosing rubber cylinder E. Hence the joint between the rubber cylinder E and side of the case B involves simply the approximation of hard rubber faces to the soft rubber washer I, whereby said joint is packed, by the screwing down of cylinder D upon post A, as tightly as may be desired.

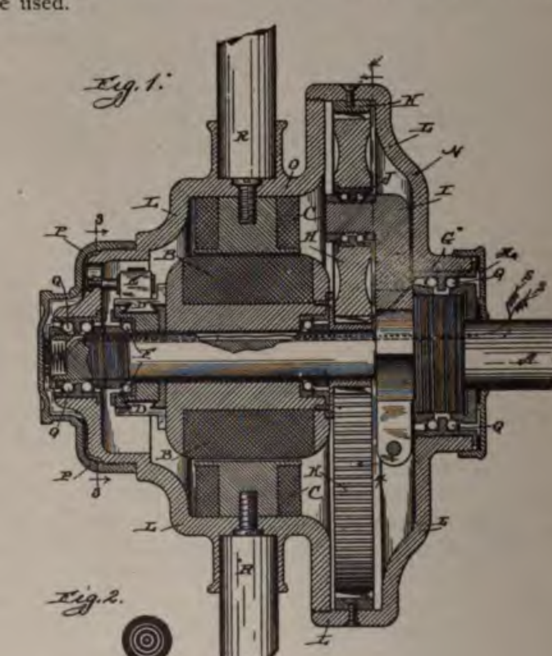
The side B may be a part of a box or case of any desired form and any electrical appliance may be inclosed therein. The invention is, however, especially applicable to induction coils, and especially those used for the production of igniting sparks for gas engines, etc. In such event it is exceedingly important that the coil and all its connections should be protected from moisture, as otherwise the efficiency of the coil rapidly deteriorates.

Three claims. Application filed May 1, 1899.

No. 638,643—Dec. 5, 1899—Means for Propulsion of Vehicles by Electricity.—F. J. Newman and Josef Ledwinka, Chicago, Ill.

The invention relates to the propulsion of vehicles by the use of electricity as a motive power, and has for its object to furnish a means for the application of said power to any vehicle and at the same time not change or disfigure the general appearance of the vehicles now in use by exhibiting the mechanical parts involved in the construction thereof; and in order to accomplish our purpose we have selected the hub of the wheel in which to install the electric motor for driving the vehicle.

Fig. 1 is a central longitudinal view through the hub of a wheel with our device installed therein and journaled on a stationary axle, showing an electric motor independently journaled with ball bearings on said axle and equipped with all the necessary parts which constitute a complete electric motor. This view also shows the motor armature supplied with gear wheel connections whereby said motor armature revolving on said axle is connected with the driving wheel of the carriage by an internal gear, which gear is attached to the hub of driving wheel. This view also shows the hub journaled on said stationary axle by ball bearings, thus enabling said hub to revolve around the motor armature, said hub carrying with it the fields of said motor, to the inner walls of which said fields are rigidly fastened. This view also shows the spoke of a wheel in position in the hub, said spoke broken off. Fig. 2 is to show four electric contact plates supplied with a spring inserted in the end of the axle to insure perfect contact. The object of these plates, which are insulated from each other, is to independently conduct the current to their respective motors in the hubs of the wheels. Two or more of these contacts may be used.



A is a carriage axle.

B is the armature of the electric motor.

C represents the fields of said motor, securely fastened to the interior of the hub of the wheel.

D is a commutator.

E is an electric brush.

F is a ball bearing, with proper cups and cones.

G is a geared pinion fastened to the armature.

H is a gear wheel which is journaled by proper bearings on the bracket, which bracket is securely fastened to the stationary axle.

J represents the ball bearings of gear wheel H supplied with cups and cones secured to the upper end of bracket I.

K is an internal gear rigidly fastened to the interior of the hub of the vehicle wheel.

L is the hub. Hub L is composed of four members, namely, the rear member M, which serves to inclose the rear of the hub and contain the dust guards; also rear member N, center member O and front member or cap P.

Q is the ball bearing for hub L, properly cupped and coned on axle A.

R is a broken spoke of the carriage wheel in position in hub L.

S represents electric conductors which make electric connection between the electric supply and the motors. These conductors are carried in a receptacle made lengthwise in the axle and brought out at the rear of the hub and thence to the electric supply.

When the parts are assembled, the operation of our device is as follows: The electric armature being journaled independently on axle A and connected, as shown and described, by gear wheel connection with hub L, and said hub L being also journaled on said axle A, therefore, when the electric current is turned on to the motor armature said armature would revolve in one direction and gear wheel H would revolve in the opposite direction, thus causing the vehicle wheel, the interior of the hub of which carries the fields of the motor, to revolve in the opposite direction to the armature thereof, and thus carry the vehicle along at whatever speed is desired and in accord with the diameter of the wheels of the vehicle.

Two claims. Application filed May 19, 1899.

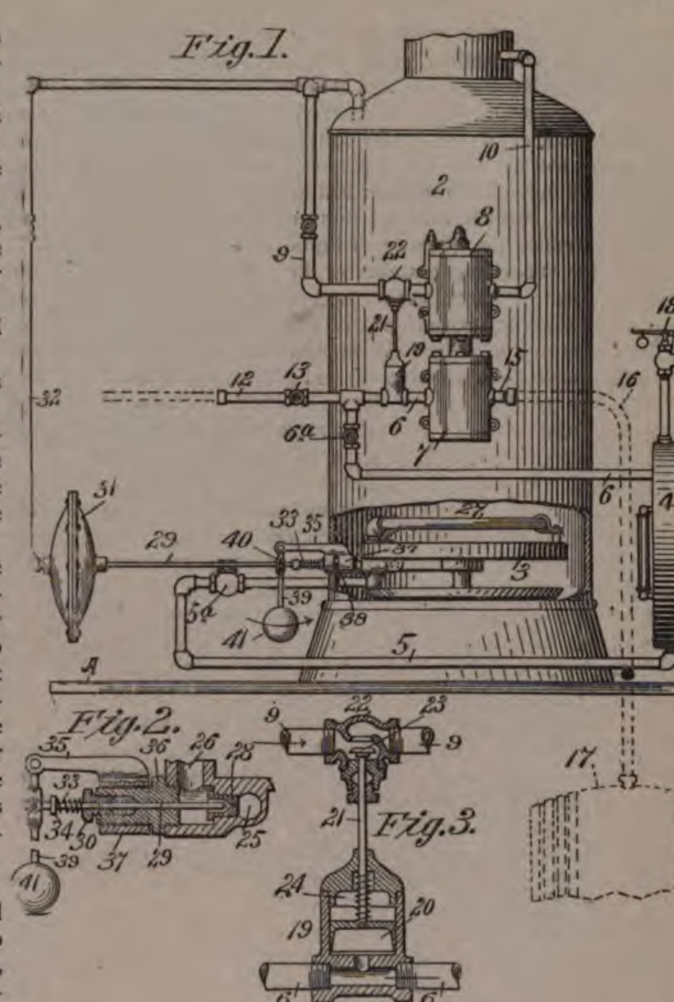
In a variable speed mechanism the combination of a stud plate, a driving stud gear, 1, the transmitting gear 2 secured to the slotted stud plate Y^2, a sleeve stud, A^2, a rotating housing, a sleeve gear passing through the latter, a series of gears varying in size located in said housing, a gear secured to said sleeve gear and meshing with a pinion carried by a stem which has its bearing in rotating arm P, a clutch member upon said stem adapted to engage any one of the various sized gears contained within said rotating housing, a shaft having a clutch, B^2, keyed to slide thereon and adapted to be engaged with any one of the various sized gears contained within said housing.

In a variable speed mechanism, a main shaft A, a counter shaft, L', a housing, B^x, mounted on said main shaft, a pinion, C, mounted on the portion C^x of said main shaft, an arm, P, also mounted on said portion C^x, means for preventing lateral shifting of said arm, a spring pressed clutch member and pinion carried by said arm, a plurality of intermeshing gears carried in said housing, an inner pinion, N', also located in said housing, a toothed ring, R', supported in said housing and means for transmitting power from said pinion and ring to the desired point.

No. 638,495—Dec. 5, 1899—Device for Automatically Regulating Supply of Liquid Fuel to Boilers of Automobile Vehicles.—Jas. H. Bullard, Sprinfield, Mass.

In the drawings Fig. 1 is a steam boiler fitted with a liquid fuel burner and supplied with Mr. Bullard's improvement. Fig. 2 is a sectional view of the apparatus whereby the supply of fuel is regulated. Fig. 3 is an enlarged sectional view of the regulating apparatus.

The especial means for regulating the supply of liquid fuel to the burner consists in the devices illustrated in Fig. 2, and 25



indicates a passage in the burner into which the liquid fuel in the pipe 5 enters on its way to the burner, and 26 indicates the passage by which said fuel reaches the vaporizing chamber 27, which consists of a coil of pipe exposed to the flame from the burner below it and wherein the fuel may be vaporized by heat before it issues from said burner to be consumed. Said chamber 27 has one end thereof in communication with the said passage 26, and its other end communicates with the interior of the burner 3, from which it issues through suitable apertures. The details of the construction of this burner are not shown, as its construction forms no part of this invention. Between said passages 26 and 25 lies the smaller passage 28, one end of which is controlled by the point of an endwise movable regulator rod, 29, which extends through a suitable stuffing box, 30, and the otuer end thereof is connected with a distensible diaphragm, which is inclosed in a suitable case, 31. The said diaphragm is of metal, and with its inclosing case 31 forms a well-known construction and requires no detailed description or illustration. The diaphragm may be concentrically corrugated, if desired, to increase the range of its distention. Said diaphragm divides said case 31 into two parts, the rod 29 passing through one of said parts for connection with said diaphragm, as stated, and the other of said parts is made steam tight in any suitable manner and placed in communication with said boiler through the pipe 32. The regulator rod 29 is provided with a spring, 33, thereon near said

burner, one end of which spring bears on a part of the latter and the opposite end against a collar, 34, adjustable to and fro on said rod, whereby the tension of said spring may be varied. When the maximum pressure is reached by the steam in the boiler, the resistance of said diaphragm and said spring on the said regulator rod will be overcome, and the distention of said diaphragm will move said regulator rod toward the burner, and the point of said rod will obstruct more or less the open passage 28 and reduce the quantity of liquid fuel passing therethrough to the vaporizing chamber of the burner, thus reducing temporarily the steam generating capacity of the boiler until such time as the withdrawal of steam from said boiler shall have operated to reduce the pressure thereof to a point which will permit the retraction of said diaphragm, aided by the said spring 33, thus moving the point of the regulator rod 29 away from the orifice of said passage 28, when the quantity of fuel moving through said passage will again increase the steam generating capacity of said boiler.

The above method of regulation is sufficient for all requirements of the apparatus under normal conditions.

Under abnormal conditions, viz., when a steep gradient is to be surmounted and extra power is required for that purpose, it becomes necessary to add instantly to the power of resistance of the diaphragm to distention, whereby a pressure of steam in the boiler may be accumulated in excess of the normal maximum, which under normal conditions is sufficient to distend said diaphragm and reduce the supply of fuel passing to the burner. To that end the following devices are provided, which not only perform the above described functions, but, further, may be so adjusted as to temporarily distend the diaphragm in the direction opposite to that in which it is distended by the boiler pressure and whereby a supply of fuel above the normal amount may temporarily be allowed to pass into the vaporizing chamber of the burner.

Referring to Fig. 2 (in which said devices are shown in detail), 35 is an arm supported on a stud, 36, screwed into the body of the burner 3, a portion of which only is shown in said figure. Referring to Fig. 1, the hub 37 of the arm 35 fits freely on said stud 36 and is revoluble thereon within the limits of a slot, 38, in said hub, through which a pin passes and enters said stud. A rod, 39, is pivotally supported in the end of said arm 35 for a swinging movement in the plane of the regulator rod 29, the latter passing through an opening in an enlarged part, 40, of said rod 39, thus permitting said swinging movement of the latter, and by the pin and slot connection of the two rods providing means for mechanically moving the regulator rod endwise by the movement in the same vertical plane of said rod 39. On the lower extremity of said rod 39 is fixed a weight, 41.

Now, it is apparent that under normal conditions the steam pressure in the boiler will, through the diaphragm operated regulator rod 29, operate to regulate the flow of fuel to the burner 3 in the manner substantially as described without imparting more than very slight oscillations to the weighted rod 39; but as soon as the platform on which this apparatus is assembled assumes an inclined position, as in the ascent of a grade, the weight 41 will be thrown against the diaphragm in the case 31 through the connection of the rods 39 and 29 and the connection of the latter with said diaphragm, and it is further apparent that the steeper the incline to be surmounted by said apparatus the more strongly will the weight bear against the said diaphragm. Thus an increase of steam pressure beyond that necessary to close, through the means described, the passage 28 may be accumulated, which can be utilized to carry said apparatus up said grade. If a descending grade is encountered, the weight 41 will swing forward, and by as much of its weight as is applied to the regulator rod 29 to push it toward the passage 28 it will to that extent reduce the resistance of the said diaphragm and spring 33 to operation by the boiler pressure, and thus insure the closing of the passage 28 under a lower boiler pressure than would be necessary on a level.

To provide for the proper functioning of the swinging rod 39 should the platform on which the apparatus is mounted be inclined transversely and longitudinally at the same moment, the hub 37 is made revoluble on the stud 36, as described, and said arm 35 and its said hub will by said weight 41 be rotated slightly on its support, thus permitting said weight bearing rod 39 to maintain a relatively perpendicular position at all times, and thus operate without a binding of the parts.

The object of the extension 12 of the pipe 6 and the valve 13 therein is to provide means for inflating pneumatic tires of the wheels with which the platform on which this apparatus is assembled may be provided. By closing the valve 6a, leading to the fuel tank 4, the air pumping cylinder 7 may be employed for this purpose by coupling a flexible pipe to said extension 12 and opening the valve 13.

It is to be noted that when fuel is forced into the fuel tank 4 by means of the pump, as described, this operation may take place while normal pressure of air is carried in said tank, and that as the fuel enters said tank and thereby increases said air pressure, that pressure in excess of the maximum which said tank is designed to carry will escape from said tank through the safety valve 18.

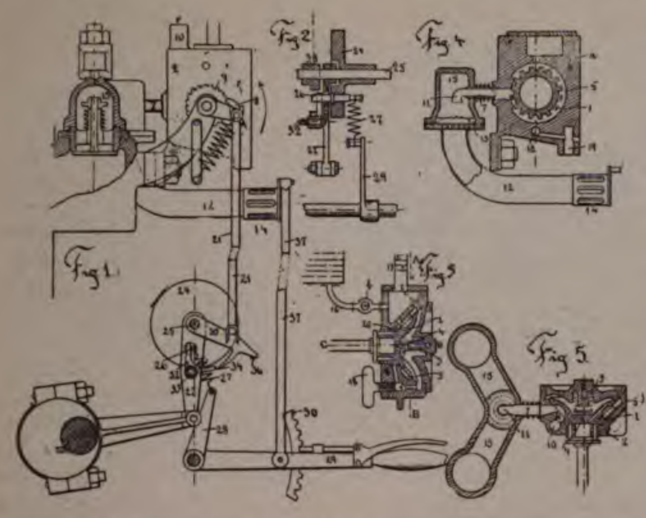
Five claims. Application filed Feb. 3, 1899.

No. 638,440—Oct. 5, 1899—Combined Distributer and Regulator for Explosive Engines.—Eugene Brillie, of Paris, France.

In the drawings Fig. 1 is an elevation, partly in section. Fig. 2 is a cross section through the axis of the regulator. Figs. 3, 4 and 5 show rectangular sections of the regulator. Fig. 3 is a longitudinal section through distributer. Fig. 4 is a section on line A B of Fig. 3, and Fig. 5 is a section on line C D of Fig. 3.

A valve, 1, preferably of conical shape, is seated in a casing, 2, where it finds a bearing on a spring-pressed center point, 4, carrying a coil spring, 3. The valve is provided corcumferentially with cells or depressions, a, placed equidistant from each other, and which at a certain fraction of a revolution of the valve are fed from a circular canal, 5, filled with oil or other liquid fuel. The casing 2 is further provided with an air supply conduit, 6, and with a conduit, 7, leading to the aspirating chamber of the engine. The rotation of the valve is effected by a ratchet, 8, actuating a ratchet wheel, 9, the ratchet receiving its motion from a regulator, which acts in case of excessive speed of the engine to paralyze the movements of the retchet, and in consequence the rotation of the valve 1, thus stopping for the time the supply of fuel to the engine, the number of teeth of the wheel 9 coinciding with the number of cells of valve 1. Air is supplied to the distributer through a vertical conduit, 10, which may communicate with a hot air source.

The apparatus operates as follows: The hand lever 29 being secured in one of its position in the teeth of the sector 30 31, which corresponds with the speed desired, the spring 27 tends to draw the projection 26 against the right side of the opening in the lever 22. While this contact is maintained the oscillation of the lever is integrally transmitted to the combination consisting of the lever 22, the weight 24, the bell



crank lever 32, the lever 35 and the catch arrangement 8 and 9. Under these conditions at each revolution an empty cell is brought before the conduits 6 7, and a moment afterward the liquid is drawn in by the aspiration of the engine. If the speed tends to become excessive, the efforts of inertia of the weight 24 increase. This weight tends to be thrown out and to bring out of contact the projection 26 and the right hand side of the lever 22 at the moment that the lower part of that lever is to the left—that is, at the moment that the end of the bell crank lever is separated from the lever 35 by the action of the stop 36. This displacement relative to the weight 24 in connection with the lever 22 makes the bell crank lever 32 oscillate around its spindle 33, and the moment afterward the lever 22 will be pushed to the right, and the end 34 of the bell crank lever, being raised, will avoid the projection or finger of the lever 35. The lever 35 rendered thus inactive, the rotation of the valve 1 will be arrested and the engine will run by the speed acquired. If that speed is slightly diminished, the efforts of inertia of the weight 24 being less, the combination will start afresh, to operate the ratchet arrangement, and in consequence the distribution of the liquid is resumed.

In modifying the position of the lever 29 the action of the spring 27 is also modified, and in consequence the speed of the engine.

To stop the engine, it is sufficient to bring the lever 29 back toward the end 30 of the sector 30 31 in such a manner that the spring 27 brings the projection 26 toward the left, and so that the bell crank lever finds itself lifted up permanently.

It is evident that the admission of air through the conduit 12 must be regulated so that the depression in the chamber is sufficient to draw in the air through the conduits 6 7.

The register 14 will be opened more according as the speed of the engine increases. To automatically regulate this condition, connect the register 14 by a rod, 37, with the hand lever 29, so as to establish a free correlation between speed dependent on each position of the lever and the corresponding section of the register. This system of distrbution is also applicable as well with two-phase and four-phase engines, single or with two cylinders to give a tsroke at each revolution. In the latter case the conduit 7 discharges into an aspirating chamber common to both cylinders. This is the case in Fig. 5.

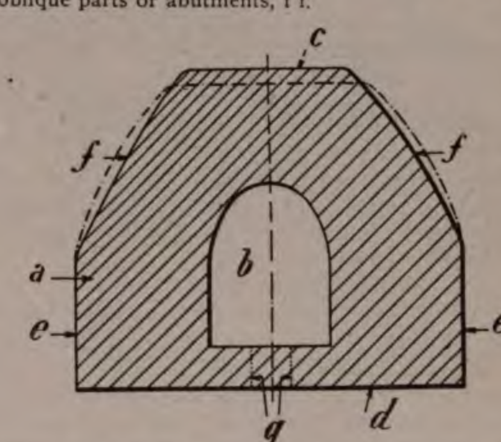
According to an engine giving one impulse per revolution or one impulse with two revolutions, the lever 22 will oscillate once at every one or two revolutions, as the case may be. The shaft 23 will then, according to circumstance, be the motive shaft itself or a shaft of half that speed.

The same regulator may be employed with other distributers than the one described—with distributers worked by a pump or by a compressor, for instance, or with any other volumetric distributer as long as they are fed with liquids. In a gas engine it may be employed as the admission valve for the gas. Finally it may be employed in all explosive engines to act on the scape valve in opening that valve or keeping it shut, according to whether the speed tends to decrease or to increase. This opening can be accomplished by the end of lever 35 or by any other suitable intermediary.

Two claims. Application filed Jan. 11, 1899.

No. 639,156—Dec. 12, 1899—Elastic Tire for Autocars.—Alfred Ducasble, of Asnieres, France, assignor to C. E. Platt, Philadelphia, Pa.

The annexed drawing is a cross section of a hollow tire consisting of a band or string, a, made of rubber or other suitable material, having an interior chamber or space, b, of any suitable shape. The section of the tire assumes an irregular hexagonal form—that is to say, the tread c, which comes in contact with the ground, is flat and is of a width less than the base d, which rests upon the rim (not shown) of the wheel. From the base d project, perpendicularly thereto, the vertical sides e e, which are connected with the tread c by two oblique parts or abutments, f f.



The inclination of the abutments f f with regard to the vertical line is so calculated as to give a maximum resistance for a minimum of volume and weight of the tire. This inclination will also present great resistance against side slipping.

It will readily be seen upon examining the drawing that the tread c—that is to say, the friction face—will, furthermore, retain an invariable width whatever may be the weight the tire may have to carry, as the bending of the tire taking place on the lateral oblique parts f f, they will under pressure undergo a swelling, as indicated in dotted lines in the drawing, but without coming in contact with the ground.

It will also be understood that the tire may be closed all around the inner space b, as shown in full lines, or that it may be open along its inner periphery at the middle of the base d, as indicated by g in dotted lines.

One claim. Application filed June 7, 1899. Already patented in France Dec. 6, 1898, No. 283,746, and in Germany Dec. 19, 1898, No. 108,055, in name of Rudolf Schmidt.

No. 639,025—Dec. 12, 1899—Incandescent Tube Igniter for Gas Engine.—Gustav Ey, New York, N. Y.

The invention is more especially designed as an improvement on the incandescent tube igniter for which letters patent were granted to Ernest W. Graef on April 11, 1899 (No. 622,892), in which the igniting tube is located in the wall of the combustion chamber and so arranged that the interior is placed in communication with said chamber, while its closed exterior end projects into the exhaust chamber of the cylinder. This igniter is reliable when applied to engines of large size; but it fails to work reliably when applied to smaller engines—as 1 h.p. or so—for the reason that the products of combustion are not present in sufficient quantity to produce the reliable working of the igniter and the regular ignition of the explosive gas and air mixture. The action of the igniting thimble is more reliable the nearer the same is placed to the exhaust flame and the products of combustion. When the exhaust flame and the products of combustion have to pass some distance before they form contact with the igniting thimble they are cooled off to such an extent that the heating up of the thimble to the proper temperature is not effected, so that the

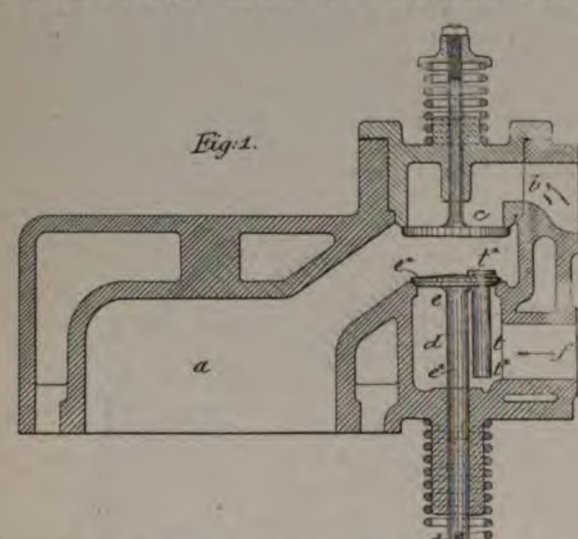


Fig. 1.

ignition action of the same is not reliably secured. However, by placing the igniting thimble as close as possible to the combustion chamber and to the adjacent end of the exhaust chamber, so that the thimble is lapped around instantly by the exhaust flame as soon as the explosion occurs and the exhaust valve is opened, then the thimble is heated to the proper degree of incandescence, so as to perform its function of igniting the next charge of compressed gas and air mixture in a perfectly reliable manner. For this purpose the invention consists of an automatic igniter for gas engines which is composed of a thimble inserted into the exhaust valve of the combustion chamber and having its open end in communication with the combustion chamber, while its closed end is located in the exhaust chamber, as will be fully described hereinafter and finally pointed out in the claims.

In the accompanying drawings, Fig. 1 represents a vertical section of the combustion chamber of a gas engine, showing the inlet and outlet valves and the improved automatic igniter inserted into the body of the exhaust valve and projecting at its closed end into the exhaust chamber.

Referring to the drawings, a indicates the combustion chamber of a gas engine of any approved construction, the cylinder of which is jacketed so as to furnish a space for the cooling medium encircling the same.

b is the gas supply pipe; c, the inlet valve of the same.

d is the exhaust chamber, and e the exhaust valve, located at the point of connection of the same with the combustion chamber.

f is the exhaust pipe.

t is a thimble which is made of platinum, nickel steel or other suitable material and which is provided near its flanged open end with an exterior screw thread by which it is screwed into a corresponding opening in the body e' of the exhaust valve in such a manner that the open end t' communicates with the combustion chamber a, while the closed end t^2 of the thimble projects into the exhaust chamber d.

Two claims. Application filed Sept. 30, 1899.

No. 638,864—Dec. 12, 1899—Automobile Watering Cart and Fire Engine.—Chas. W. Collyer, of Lynn, Mass.

The invention is fairly well described in the two claims here given:

1. In a vehicle, the combination with a motor, of propelling mechanism, a clutch for connecting and disconnecting the motor with the propelling mechanism, and a lever for operating the clutch, arranged convenient to the driver, a water tank adapted to contain a large quantity of water suitably mounted upon the vehicle, a pump, pipes connecting the tank with the intake of the pump, a clutch to connect the pump with the motor, a lever for operating the clutch, arranged convenient to the driver, discharge pipes provided with valves connected with the outlet of the pump, the whole being so organized and arranged that the machine may be propelled to carry the water to the place where it is desired to be used, so that the vehicle may stand still and pump water from the tank into the discharge pipes, and also so that the vehicle may pump water into the discharge pipes while it is in motion.

2. In a sprinkling cart, a sprinkling pipe arranged with a longitudinal diaphragm integral therewith, valves at the ends of the diaphragm and means connecting the valves for simultaneously opening and closing the same so as to cut off the water from the portion of the sprinkling pipe between the valves.

Three claims. Application filed Nov. 18, 1898.

No. 638,874—Supporting Device for Battery Electrodes and Cups.—Roderick Macrae, Baltimore, Md., assignor of one-half to William C. L. Eglin, Philadelphia, Pa. Filed April 8, 1899. Serial No. 712,271. (No model.)

No. 638,730—Clamping Tool for Manufacturing Battery Electrodes.—Roderick Macrae, Baltimore, Md., assignor of one-half to William, C. L. Eglin, of Philadelphia, Pa. Filed April 8, 1899. Serial No. 712,269. (No model.)

No. 638,731—Device for Automatically Shaping, Delivering and Stacking Battery Plates.—Roderick Macrae, Baltimore, Md., assignor of one-half to William C. L. Eglin, Philadelphia, Pa. Filed May 4, 1899. Serial No. 715,629. (No model.)

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of THE HORSELESS AGE, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

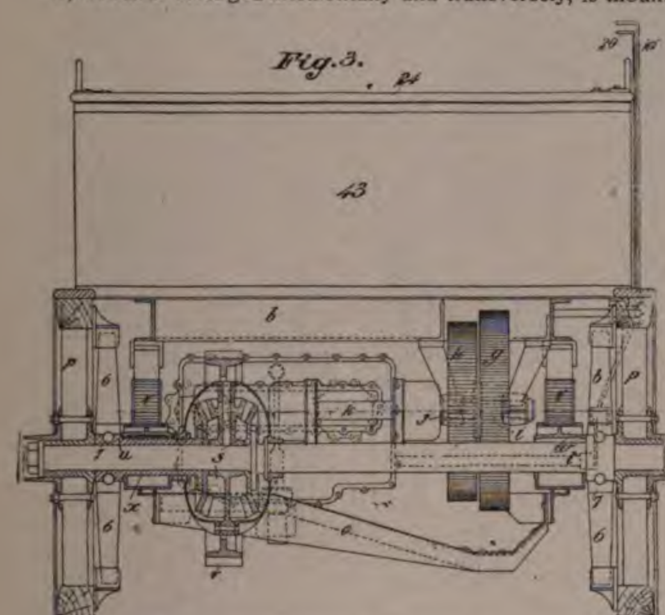
ENGLISH PATENTS.

No. 6,828—Oct. 14, 1899—Improvements in Motor Propelled Road Vehicles.—John I. Thornycroft and the Carriage and Motor Co., Ltd., Chiswick, County Middlesex, England.

This invention has reference to a construction of motor propelled road vehicles designed to travel over rough or uneven roads in a smoother manner than usual and without undue shock to the driving mechanism.

For this purpose the steam or other motor, a, is arranged below and carried by the frame b of the vehicle, which is provided with suitable bearings, c, wherein the motor driving shaft d, which is arranged horizontally and transversely, is mounted

Fig. 3.



to revolve. Upon one end of this driving shaft are mounted two toothed pinions, e and f, of unequal diameter that are adapted to be put in and out of gear with two toothed wheels, g and h, that are also of unequal diameter and are fixed upon a short transverse shaft mounted in bearings suspended from the bottom of the frame, the two sets of toothed wheels admitting of two different speeds being obtained. This short transverse shaft i is connected at one end by a universal coupling to one end of a transverse link or shaft at k (hereinafter called the intermediate shaft), the other end of which is connected by a similar coupling to one end of a second short transverse shaft, m, mounted in bearings, n, carried by a lower frame, o (hereinafter called the perch frame), which is supported from the axles of the main and leading carrying wheels p and p' respectively of the vehicle. The said second transverse shaft m has fixed thereto a pinion q in gear with a toothed wheel, r, connected to differential gearing, s, of the ordinary known kind carried by the main driving axle t of the vehicle, the said differential gearing being connected on the one side to the said axle and on the other side to a sleeve, u, loose on the said axle. The end portion of the vehicle over the main driving axle t is supported by springs, for example two laminated carriage springs, v (Figs. 1 and 3), carried by two axle boxes, one of which, viz., w, is mounted upon one end portion of the driving axle t, and the other, viz., x, upon the sleeve u surrounding the other end portion of the said driving axle. The other end portion of the platform is supported on springs, for example two pairs of carriage springs, y, arranged to form a bow spring, carried by the leading axle z of the vehicle (Fig. 1). The perch frame o, which may conveniently consist, as shown, of a pair of longitudinal members connected by transverse members, may be connected at one end to the axle boxes w and x on the main driving shaft t and at the other end to the leading axle z of the vehicle. As will be seen, the arrangement is such that the frame b of the vehicle is free to rise and fall vertically to an extent limited by the carrying springs v and y, without interfering with the driving of the main axle t from the motor driving shaft d, the intermediate length l of shaft coupled to the two short transverse shafts, i and m, becoming more or less inclined to the horizontal as the platform rises and falls and sliding endways relatively to the short shafts. To permit of this motion of the intermediate shaft, each of the couplings that connects its ends to the adjacent transverse shafts i and m comprises a socket, 1, fixed to the short shaft i or m and formed with oppositely arranged longitudinal recesses, 2, in which are fitted a pair of blocks, 3, that are rounded on their outer ends and are journaled upon a cross pin, 4, that is journaled in one end of the intermediate shaft l. The arrangement is such that rotary motion can be transmitted from the shaft i to the intermediate shaft l and from this latter shaft to the shaft m, and that the intermediate shaft is free to turn in directions or planes at right angles to one another and about either socket as a center. The pair of blocks 3 in one of the sockets is held endways therein by suitable means, such as fixed pieces of metal, 5, having concave bearing surfaces, against which the correspondingly formed blocks 3 can work, the pair of blocks 3 in the other socket being free to slide endways in the recesses 2 to accommodate the angular movement of the intermediate shaft.

Fig. 4.

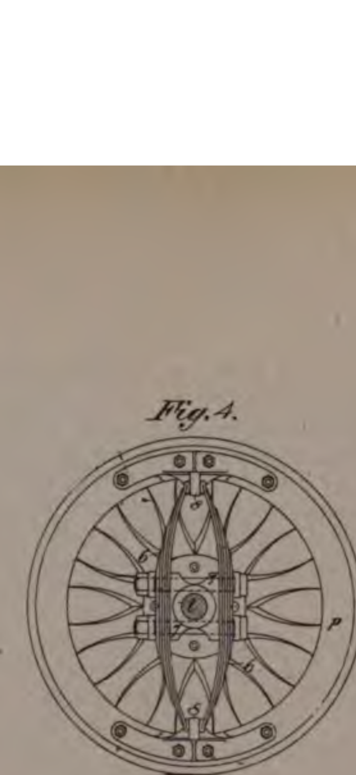
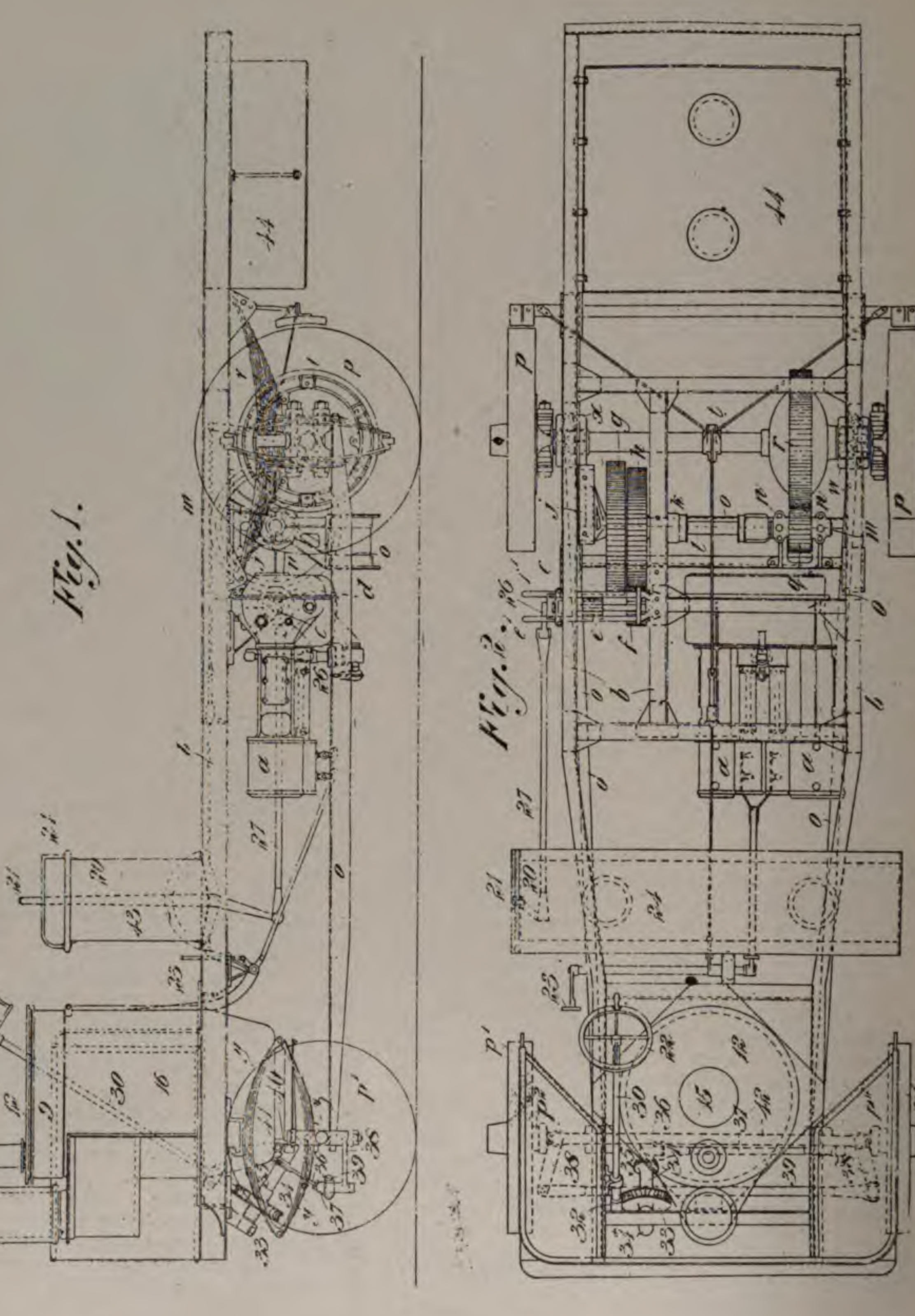


Fig. 5.

To prevent or mitigate the transmission of shocks from the pair of main driving wheels p of the vehicle to the driving mechanism, each of the said driving wheels is mounted to rotate about the driving axle t, and is driven through spring or flexible connections. In the arrangement shown for this purpose in the accompanying drawings, each of the main driving wheels p is driven through a pair of stiff laminated carriage springs, 6, that are fixed at their central portions to the opposite sides of a block, 7, carried by the driving axle t and the ends of which bear against opposite sides of diametrically arranged lugs or projections, 8, extending from the inner side of the corresponding driving wheel p. One of the spring carrying blocks 7, the right hand one in Fig. 3, is fast on one end of the driving axle t, and the other is fast on the driving sleeve u on the other end of the said axle, the arrangement being such that each wheel will be driven through a pair of springs, 6, which will yield to some extent at starting, and



THE THORNYCROFT STEAM VEHICLE

when the corresponding driving wheel meets with an obstruction on the road, and so allow of a limited but controlled movement between the driving wheel and the driving mechanism.

When the motor employed is a steam motor, as in the example shown, there may advantageously be employed a steam boiler comprising, as shown in Fig. 1, two annular vessels, 9 and 10, connected by an annular group of straight but inclined water tubes, 11, the upper vessel 9 constituting a steam and water vessel, and the lower vessel 10 a water supply vessel. The two annular vessels, which may be pressed to shape, are closed, the one at the top and the other at the bottom, by annular plates, 12, by removing which direct access can be gained to the water tubes for the purpose of cleaning or withdrawing them. The boiler may be so connected to the frame b that the lower water vessel extends downwad from the bottom side thereof, as shown, the fire grate 13 being suitably carried by the lower water vessel 10. The top annular plate 12 of the upper steam and water vessel 9 is provided with a central fuel charging aperture, 14, controlled by a door, 15, and the water tubes are surrounded by a suitable casing, 16, that is in connection at one side with a chimney, 17. When using inferior fuel, which forms a large quantity of clinker, necessitating frequent clearing of the fire, a small passage, 18, normally closed by a door, 19, may advantageously be formed through the lower water vessel 10 so that clinker can be drawn out on a level with the fire grate. By the construction described the water tubes can be readily cleaned internally and the fire grate can be readily cleaned from clinker.

In the arrangement of vehicle now being described by way of example, the steam boiler, the starting, stopping and reversing lever 20 and speed changing lever 21, the steering wheel 22 and the brake lever 23 are arranged at the forward portion of the frame b, the remaining portion of the said frame, which is made flat, serving to support a platform on which the load to be carried is placed, or to receive a car body in which the load is carried and which can be made readily removable so as to permit of its being replaced by car bodies of different design in order to adapt the vehicle for carrying loads of various kinds. In such an arrangement the rear axle t is the driving axle, the driving wheels p on which are driven as hereinbefore described, the front axle z being the steering axle. The starting, stopping and reversing mechanism, which may be of any suitable construction, is controlled by a hand lever, 20, at one side of the driver's seat 24, which is behind the steam boiler. The reversing and speed changing lever 21 may, as shown, be arranged at the side of the lever 20. In the example shown, the two pinions e and f are feathered to the shaft d and are moved endways thereon by means of two rods e^1 and f^1, which are attached respectively to the pinions e and f and are carried by and slide within suitable brackets secured to the under frame of the vehicle, a locking device being provided to enable either pinion to be placed in action or both out of action, as may be desired.

The steering gear may be of any suitable construction. According to the arrangement shown in Figs. 1, 2 and 9 it comprises an inclined steering shaft, 30, provided at its upper end with a hand wheel, 22, and at its lower end with a worm, 32, in gear with a worm wheel, 33. This worm wheel is mounted to rotate upon an inclined shaft, 34, and is provided with a sleeve, 35, carrying an arm, 36, that is connected by a rod, 37, to one of the two steering arms 38 connected to the short axles p^2 of the leading wheels p^1 of the vehicle, the two arms 38 being connected by a rod, 39. The short axles p^2 are, as usual, mounted to turn about vertical axles carried by the bifurcated ends z^1 of the leading axle z. The shaft 34 carrying the sleeve 35 is fixed at its upper end, as by a bracket, 34*, to the frame b, and at its lower end is held in position by a socket, 40, in which it fits and which is restrained from vertical movement by a link, 41, and from horizontal movement by a rod, 42, connected to the leading axle z. By this construction the forces required to move the steering wheels are confined within the steering mechanism, no force having to be transmitted through the supporting springs y of the forward end of the vehicle. In this way the vehicle is allowed to move on its springs and the latter are allowed to work, without the steering wheels being thereby caused to change their direction.

The vehicle may be provided with side coal bunkers at its forward end, and with water tanks, one of which, shown at 43, may be located under the driver's seat and another or others under the rear part of the frame at 44.

Seven claims.

WANTED.

Special contributors to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

FOR SALE.

Haynes-Apperson two-passenger automobile; folding buggy top. Will sell cheap. Address
F. L. SWEANY,
1700 Tioga St., Philadelphia, Pa.

WANTED.

Catalogs, prices, etc., from manufacturers of steam and gasoline motor machines, who want first-class representatives in Indiana. We expect to engage largely in the Automobile business and are prepared to represent, in a first-class manner, any line we select. C. G. FISHER & CO., Indianapolis, Ind.

FOR SALE.

A Stanley Locomobile No. 1. Having been carefully used is in good condition. Price, $500 F.O.B. Only reason for selling is, I wish to buy four-seated steam carriage. Address M GILLET GILL,
Care Martin Gillet & Co. Baltimore. Md.

FOR SALE.

Stanley Locomobile, model 1, in good order, has run 400 miles. Electric bell, cyclometer and small electric lights over steam and water gauges, for night work, have been added. Price, $600.00.
Address ALFRED I. DU PONT,
Henry Clay P. O., DELAWARE.

MAKERS OF STEAM VEHICLES

wishing representation in Mexico, are invited to correspond with undersigned, agents for Baldwin Locomotive Works, Westinghouse Electric and Manufacturing Co., and other leading American Manufacturers. G. y O. BRANIFF & CO., Calle de Cadena, 19 Mexico, Mex.

Have 3 valuable inventions on boiler and one on engine for steam wagon. Will accept position and royalty from reliable manufacturers or any one going into motor vehicle business.
Address ENGINE.
Care HORSELESS AGE.

Complete Lines of **UPRIGHT DRILLS**

From a light Friction Drill to a 42-in. B. G. P. F. Drill.

SEND FOR CATALOGUE.

W. F. and John Barnes Co.,

996 Ruby Street, = Rockford, Ill.

VOLUME FOUR COMPLETE.

(April 5th to September 27th, 1899, inclusive.)

To New Subscribers for Two Years.

We wish to place these volumes in the hands of persons permanently interested and therefore offer them only to those who will subscribe for two years from April 5th, 1899. :: :: ::

SEND $4 AND GET THIS VOLUME BEFORE IT IS EXHAUSTED.

½ to 2 H. P. Gasoline Motors

(WITH OR WITHOUT WATER JACKET)

FOR

AUTOMOBILES AND LAUNCHES.

VERTICAL OR HORIZONTAL.
ELECTRIC IGNITION. :: ::

☞ Large factory suitable for experimental work. Any style of carriage built to order from owner's drawings. Larger sizes for heavy vehicles in cou se of construction.

MALTBY AUTOMOBILE CO.,

10-12 Clinton Street, Brooklyn, N. Y.

AUTOMOBILE CHARGING AND REPAIR STATION

We Make, Rent, Recharge and Repair

STORAGE BATTERIES.

THE STORAGE BATTERY SUPPLY CO.

Established 1891. Telephone, 1065 Madison Square. Incorporated 189

OFFICE AND WORKS: 239 East 27th St., New York City.

LEONARD HUNTRESS DYER,

Specialty: Patents and Patent Causes,

908 G Street, N. W.

Cable Address: "Dyerpatent, Washington." **WASHINGTON.**

EXPLOSIVE MOTOR NUMBER.

TO be issued January 17th. Dealing thoroughly with gasoline, kerosene, alcohol, etc., vehicle motors and motor vehicles. Leading articles by **R. I. Clegg, E. J. Stoddard, P. M. Heldt, Herbert L. Towle, P. L. Tygard** and others. **Eighty pages,** many illustrations. **Ten cents,** stamps or coin. **Subscription:** Domestic, $2.00; foreign, $3.00 a year in advance.
☞ Send for our **STEAM BOILER NUMBER OF DECEMBER 6, 1899,** 10 cents.

THE HORSELESS AGE, 150 Nassau Street, N. Y. WEEKLY. ESTABLISHED 1895.

STEAM IS THE BEST POWER FOR AUTOMOBILES

Steam Motor Wagon.

THIS STYLE NOW READY.

OTHER STYLES TO FOLLOW.

THE Carriage illustrated here is one that will satisfy the most critical, for in it is combined the finest carriage work and the best machinist skill and workmanship, and it is the most practical and satisfactory pleasure carriage one can have.

FOR FULL PARTICULARS AND PHOTOGRAPH ADDRESS

STANLEY MANUFACTURING CO.,

No. 117 LINCOLN STREET, BOSTON, MASS.

MOTOR WHEELS.

STEERING DEVICE

WITH

BALL BEARINGS.

RIMS. CRESCENT SHAPE AND FLAT BASE

FLARING EDGES IF DESIRED.

WESTON-MOTT CO., UTICA, N. Y.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. V. NEW YORK, DECEMBER 27, 1899. No. 13.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

Damage Suits.

One of our subscribers writes that he would buy a motor carriage immediately if he were not afraid of frightening horses and incurring the risk of damge suits. He instances the experience of a friend who on the occasion of a recent trip across country found that the horses of the cities and towns took no notice of his motor carriage; but the horses encountered on lonely country roads almost invariably gave trouble. This difference in the equine attitude is accounted for, no doubt, by the fact that the city horse is accustomed to all kinds of sights and noises to which the country horse is a stranger, and it may be also that the presence of numerous other horses in the street has a sedative effect on the equine mind. However this may be, it is certain that the greatest caution is required of drivers of motor vehicles in rural districts for the reason above named and because there are encountered the strongest prejudices against the innovation in road locomotion, and the most conservative and narrow-minded administration of the law.

But the damage suit is fast losing its terrors. While many have been threatened with such procedure, very few cases have come to trial, and in only one case, so far as the editor knows, has an adverse decision been given, and this was for a small amount and the decision could probably have been reversed on appeal. So long as the driver of a motor carriage observes the ordinary rules of the road and exercises further courtesy to drivers of horses whose animals show fright at his approach, he is doing all that is incumbent upon him as a law-abiding citizen.

We should advise all who are in the same frame of mind as our correspondent to dismiss the fear of liability at once. Opposition is fast disappearing. An occasional threat of prosecution may be looked for, but very seldom will a case actually come into court, and when it seems likely to reach that stage communicate at once with the Automobile Club of America, Waldorf-Astoria, New York, one of whose chief objects is to protect the rights of all users of automobiles.

Storage of Gasoline.

The Bureau of Combustibles in New York is turning its attention to the storage of gasoline by motor vehicle owners, and the head of the Bureau states in an interview published in this issue that automobile owners are now violating the law in reference to the storage of this combustible and will hereafter be held to a stricter account for such violations. The present law is reprinted elsewhere, as also a very lucid and well considered communication from a subscriber on his experiences in endeavoring to determine his rights in this respect under the New York laws.

The present statutes are unquestionably the result of long experience in the storage and handling of the inflammable substance, and are no doubt reasonable so far as the general provisions are concerned. Large quantities of gasoline cannot with safety be stored in cities except under the strictest precautions and under the direct care of responsible persons. Storage below the ground level is undoubtedly safest and should be required in every case where the amount exceeds the contents of an ordinary vehicle tank. Where the amount kept does not exceed 10 gals. the danger is not so great, but even then careless handling may lead to disastrous results. So far as the responsibility of the persons having access to the gasoline is concerned, the insurance companies will probably be the best judges of that, and the conditions of the policies will go far to settle the whole question, for as insurers of the buildings and property jeopardized they will be more directly interested than any one else in the enforcement of suitable precautions for the safe keeping of the dangerous substance. The automobile is not yet in such general use that the insurance companies have found it advisable to take concerted action on this storage question, but with the increasing use of the new vehicle, action cannot be long deferred.

Sensible automobilists themselves will recognize the necessity of stringent measures to protect property in crowded centers from the possible dangers of the careless storage of large quantities of gasoline for use in automobiles. The precise nature of the regulations needed is of course open to discussion, and we invite our readers to ventilate their opinions in our columns. Here again the Automobile Club of America might render a service by opening a discussion of the subject at some of its meetings.

Lead Cab Discoveries.

In one respect at least the Lead Cab Trust has proved itself a public benefactor. It has furnished complete, open and cumulative demonstration of certain truths.

At great outlay and after long continued experiments in sulphating, buckling, short-circuiting and disintegration, it has rediscovered the storage battery which so many have paid dearly to discover before. It has given us incontrovertible evidence that lead is heavy both in cabs and in Wall street. The volatile and corrosive nature of sulphuric acid has been reaffirmed for us through the destructive effect of the gases it gives off on the wooden bodies of the cabs. The racking strains of rough streets on 2-ton vehicles running at high speed have been fully exhibited. Much valuable information regarding the properties and durability of rubber tires under heavy strains has also been gathered by the Trust. Although it was not the primary object of the Trust to furnish all this information gratuitously to the public, such has been the benevolent result of its labors in the field of motor vehicle promotion and we gladly embrace the opportunity to suitably recognize its distinguished services in this respect.

If the Trust has also discovered that success in this field requires something more than bluff and the organization of goose-egg corporations, and that The Horseless Age is an independent and fearless journal, committed to the cause of a legitimate industry and inflexibly opposed to everything inimical to that industry, it has afforded a most shining example to deter such freebooters from invading the industry in future. To be sure, all these things were known before to competent engineers and conscientious investigators as well as to the inner circle of storage battery gamblers themselves, but in thus piling proof Ossa upon Pelion the Trust has not spent its millions wholly in vain. Lead Cab promotions are not likely to be repeated soon.

Tell your discoveries to the investing public, gentlemen of the Lead Cab Trust, and The Horseless Age will commend the honesty of your intentions even if it cannot indorse your engineering.

Motor Vehicles Before The Franklin Institute.

At a meeting of the electrical section of the Franklin Institute last Friday in Philadelphia the subject for discussion was electric automobiles.

Pedro G. Salom, a storage battery inventor and promoter, said a great many improbable and impossible things about storage batteries. He thought the automobile of the future would be a light electric vehicle. Mr. Salom then descended to earth and admitted that storage batteries of the present were very heavy and that the cost and maintenance of pneumatic tires was a serious item in the electric vehicle problem. This decidedly incomplete enumeration of the obstacles besetting the electric vehicle was followed by the cheerful assurance that lighter storage batteries were now being made and that the tire problem had been solved.

Mr. Salom is by profession a chemist and presumably at one time was familiar with the chemical composition and weight of lead. When he said that lighter batteries are now being made he spoke the truth, but he must know and should have admitted that if they are materially lightened it is done at the expense of durability and efficiency. Four years' connection with the Lead Cab Trust has obscured Mr. Salom's memory. As to the tire problem, improvements are no doubt being made, but if the tire problem had been completely solved the storage battery problem would still remain unsolved. The expense of loading it on a vehicle would be somewhat lessened, but its inherent defects would remain unchanged.

Rudolph Hunter, an electric inventor, expressed the opinion that the electric vehicle had a very narrow field of usefulness and predicted that by far the greater part of motor

traffic would be done by gasoline motors. He said the electric vehicle had been practically abandoned in France. Prof. W. D. Marks, a well-known theoretical and practical electrician of the Quaker City, took the same view of the subject as Mr. Hunter.

Altogether, with the exception of the special pleaders of the Lead Cab Trust, almost all of those who took part in the discussion recognized that electricity is not the coming power for motor vehicles.

Foreign Experience.

One of the participants in the discussion at the Franklin Institute last Friday referred to the experience of the French as of great value in determining the merits of the different powers competing for the propulsion of vehicles. The electric vehicle, he said, had virtually been abandoned in France, while the gasoline motor had come to be regarded as the only power fitted for general use.

It is not strictly true that the electric vehicle has been abandoned in France. It is to some extent used in Paris for luxurious purposes, and now and then an attempt is still made to introduce it in the field of commerce, but these attempts generally are short lived. The newspaper reports of foreign activity in electric vehicles that have been circulated on this side of the water of late were inspired by the Lead Cab Trust to bolster up its shrinking stocks. The electric vehicle has been tried abroad and found wanting for all except luxurious work.

International Cup Complications.

The Automobile Club of France is rent asunder with dissension over the International Cup races. Three representatives of the Club, MM. Knyff, Charron and Girardot, have been elected to take part in the races, but many of the members are not satisfied with the selection and are pressing the claims of their favorite chauffeurs for recognition. The feeling runs high and some desertions from the French standard are reported. M. Lemaitre, a veteran chauffeur, has announced his intention to race for the cup under the Belgian colors. Other members may secede and compete under German or Swiss colors. Hence the racial lines will be pretty well mixed up in the first international contest.

Those who look upon the motor vehicle as a business proposition and not a mere plaything of the rich, can afford to look on complacently while the sportsmen settle their trivial differences.

The Park Permit Comedy.

President Clausen, of the New York Park Board, is playing an opera bouffe part in his treatment of the automobile question. His bursts of high-handed authority, quick recessions and general testiness ill become a civic official at the dawn of the twentieth century. Mr. Clausen rudely tramples under foot the accepted road laws of the ages and even attacks the broad principles of the individual rights of the citizen. He arrogates to himself the right to issue permits and to exclude from the Park whomsoever he will. He revokes the permits of those who displease him and then reissues them after the offenders have made lowly obeisance to him. Altogether Mr. Clausen is quite Oriental in the magnitude of his powers and his exercise of them.

Automobile Club to the Rescue.

We wish to direct the attention of the Automobile Club of America to a letter published among our "Communications" from John C. Higdon, a patent attorney of St. Louis, who has been sued for damages by the owner of a horse which it is alleged ran away through fright at an automobile he was running. He needs the moral support of the club in defending the suit.

Motor Liveries.

A number of enterprising livery stable keepers in different parts of the country are preparing to take charge of automobiles by the week or month. They have installed electric plants for charging batteries, secured the services of mechanics competent to care for and repair the different classes of vehicles, and are already finding customers. That they will find more and more customers as the industry progresses goes without saying, and it is the early bird that catches the worm. Later they will feel a demand for expert motormen, just as they now do for coachmen.

We have not heard anything more about the motors the Lead Cab Trust was going to put on the Erie towpath to drive all the canal mules out of business. Perhaps the Trust got as far as the business end of the mules and had to give it up. There are "more kicks coming."

The Lead Cab Trust has lately been badly damaged by both fire and water—by fire in Forty-second St. and by water in Wall St.

Denied by the Automobile Co. of America.

The Automobile Co. of America and the American Motor Co. deny that they are interested in any project to combine with the two old established carriage and wagon concerns mentioned in our last issue. They state that they are well satisfied with their prospects and do not wish to combine with any one.

Storage of Gasoline in New York.

George Murray, chief of the Bureau of Combustibles, New York city, who is preparing a report to Fire Commissioner Scannell, concerning the storage of the products of petroleum in automobiles, said recently that he believed it to be the duty of the police to take cognizance of the violation of the law by automobilists. He added that the statute is emphatic and plain.

"There is no going behind the returns," he continued, "and while I am a believer in automobilism, I deem it my duty to point out the fact that every person who operates an automobile which uses petroleum or any of the products thereof is committing a misdemeanor, according to the express words of section 765, chapter 378, of the laws of 1897, the execution of which devolves on this bureau. The lawmakers framed the act without looking ahead to the time of the automobile run by benzine, gasoline and other articles prohibited in the act. It will be necessary to amend this law to save many prominent men from committing a misdemeanor. The law prohibits the use of such articles, except under certain conditions, and those conditions apply only to certain kinds of building construction. Our expert, W. S. Purdy, has found that all of the articles used in gasoline and petroleum automobiles have a gravity of more than 50 points to insure their efficiency for motive power. This bureau cannot take cognizance of the violation of law in the way of issuing permits, but must enforce the statute as it is." The section of the law is as follows:

Section 765. No person shall have, keep upon sale, or store in any place or building within the corporate limits of the city, any crude petroleum, coal, or any similar oil, nor any of their products, either of which shall emit an inflammable vapor at a temperature below 100 deg. of Fahrenheit, except under the following provisions; or any of their products may be stored in detached or properly ventilated warehouses, the outer walls of which shall be stone, brick or iron, especially adapted for the purpose by having raised sills, at least 2 ft. high, or the ground floor of which shall be at least 2 ft. below the level of street or adjoining yard, or so constructed as to actually prevent the overflow of such substances beyond the premises where the same may be kept or stored; which said warehouses shall not be occupied in any part as a dwelling; and if less than 50 ft. from any adjacent dwelling the same must be separated by a brick or stone wall at least 10 ft. in height and 16 in. thick, constructed in such manner as said commissioner may prescribe; but the same may be stored in such other manner as said commissioner may designate, under a special permit issued therefor. No refined petroleum, kerosene, coal or similar oil, or earth or rock oil, or machinery oil, or any product thereof to be used for illuminating or heating purposes, which shall emit an inflammable vapor at a temperature below 100 deg. Fahrenheit, shall be kept upon sale or stored within the corporate limits of the city. All said articles shall be tested and their quality determined by sanitary surveyors authorized by said commissioner, using G. Tagliabue's instruments, or such other instruments as may be designated by said commissioner, the barrels or packages containing the same to be legibly stamped or marked with said inspector's official stamp or mark. No refined petroleum, kerosene, gasoline, naphtha or benzine, benzole, camphene or burning fluid, or products or compounds containing any of said substances, when temporarily placed above the cellar or basement of any building, and in barrels of not over 45 gals. each, or in metallic vessels or tanks, shall exceed in the whole quantity the contents of 50 of said barrels, provided, however, that the whole quantity of said refined oils that may be so kept or stored over night shall not exceed the contents of 10 of said barrels, unless stored in the manner provided for storing crude petroleum; and when stored in cellars or basements, surrounded by walls of brick or stone, and at least 2 ft. below the level or grade of the sidewalk, street or land adjacent, the whole quantity shall not exceed the contents of 150 barrels, unless stored in warehouses specially adapted for that purpose, as required for the storage of crude petroleum under this section; provided, also, that no quantity of said oils greater than one barrel shall be stored or kept in any building occupied in any part thereof as a dwelling. No refined petroleum, kerosene, gasoline, naphtha, benzine, benzole, camphene, burning fluid or products or compounds containing any of said substances, shall be kept or stored on or above the first story or floor of any building exceeding in the whole quantity the contents of five barrels of 40 gals. each. In no case shall any of the articles named in this section be allowed to remain on the sidewalk beyond the front line of any building, or in or upon the streets, docks, piers, bulkheads, slips, highways or public places a longer time than is actually necessary for the removal or loading of the same, and said commissioner may establish and enforce general regulations and issue such orders and special directions relative to the handling, lightering, carting, loading, unloading, transportation of the several articles named under this section, as in their discretion shall be deemed necessary for the public protection, and said commissioner may issue special permits authorizing the keeping of any of the articles enumerated under this section in buildings, tanks or structures fire-proof throughout, in such quantities, in such manner, and subject to such regulations as shall tend to secure the same against danger.

Lead Bluff in Boston.

Mayor Quincy, of Boston, has signed an order granting routes to the Boston Transit Co. for a motor merchandise and passenger traffic. The routes run through the choicest residential sections of the city.

The routes are as follows:

First—From St. Mary St. over Beacon, Dartmouth, Arlington, Boylston, Tremont and Sudbury Sts., Haymarket Sq. and Canal St., to the North Station; return over the same route.

Second—Adams Sq., over Brattle, Tremont and Boylston Sts., Park Sq., Columbus Ave., Seaver St., Blue Hill Ave., to Franklin Park; return over Blue Hill Ave., Seaver St., Columbus Ave., Park Sq., Boylston, Tremont, Court and Washton St., to Adams Sq.

Third—Beginning at the corner of Tremont and Park Sts., over Park, Beacon and Arlington Sts., and Commonwealth Ave., to the Fenway and return.

Fourth—In case of blockade, arising in case of fire, repairing streets or other cause, to use such streets as may be necessary to pass around such obstruction.

This company expects omnibuses will be put on the street just as soon as they can be delivered. The first route started will be the one in Beacon St.

The omnibus that has been designed is after the diligence pattern, seating 20 persons altogether, 4 or 6 outside.

The company has been anxious to secure the privilege of running omnibuses through Commonwealth Ave., and the Fenway, but is prevented by the restrictions of the Park Commission.

LONDON NOTES.

London, Dec. 14.

PROJECTED TRIALS OF ELECTRIC VEHICLES.

A meeting of the representatives and manufacturers of electric vehicles was held at the Automobile Club of Great Britain on Monday to discuss the question of organizing a series of trials of such automobiles next year. After a discussion it was resolved: 1. That trials of electric vehicles be held in 1900 under the auspices of the Automobile Club. 2. That they consist of four consecutive days' trials as follows: (a) A run over a good course; the run to be of unlimited length; the driver to declare when the run is finished. (b) A run of 30 miles in a hilly district. (c) A run of 30 miles over an average road. (d) A run of 30 miles over a fairly flat road. The points to be taken into consideration are: The consumption of energy, average speed, the number of passengers carried, etc. The competing vehicles will be continuously under the supervision of the club officials during the four days' trials.

LONG DISTANCE RUNS OF ELECTRIC CARRIAGES.

An interesting experiment in electric motors took place on Wednesday, the 29th ult., when a trip was made by A. A. Jordan, of the Electrical Undertakings Co., Camden town, N. W., from London to Brighton in an electric game cart, with a view to demonstrating the possibility of journeying between London and Brighton (52 miles) in one day, with only one charge of the batteries. There was considerable interest displayed in the event, which proved successful. Piccadilly Circus was made the starting and the Hotel Metropole, Brighton, the ultimate destination. The traveling averaged 11 1-3 miles per hour, without recourse to a recharge the vehicle was successful in completing the distance in good time. The weight of this game cart with two passengers was about 2,200 lbs., of which the accumulators used accounted for about 1,000 lbs., so that the proportion of accumulators to the total weight approached 50 per cent. The accumulators in question consisted of 42 four-plate cells of the Leitner type, having an ampere-hour capacity of about 180. It is interesting to know that the voltage on open circuit on arrival at Brighton was as high as 84 volts, which is equivalent to 2 volts per cell. The open circuit voltage on the cart's starting in Piccadilly was 94 volts. The cart is propelled by two motors, which drive the hind wheels independently, and a series-parallel controller is arranged to vary connections between motors and battery. The accumulators, however, are always kept in series. The controller gives six speeds forward and two backward. The most economical steps of the controller are third and fifth position, equivalent to 8 and 25 miles per hour on the level. In the third position of the controller the motors are in series, and they are in parallel at the fifth step. The motors are also used to brake the car, and in this way a considerable amount of energy is restored to the battery when going down hill. Again on Sunday last, the 10th inst., two of this company's carriages were run from London to Brighton, each on one charge. One of the carriages was driven by Mr. Jordan accompanied by the secretary of the Automobile Club. The run was made on one charge only, the average speed being a little over 9 miles an hour. The identical battery used in the first run was employed in the second run. It is a four-plate (Leitner) battery of 40 cells, with Leitner motors. This is looked upon as a very notable performance, the battery being, it is claimed, in no way depreciated by the severe tests which are entailed in a run upon the Brighton road, where so many hills have to be contended with.

THE REGULATION OF TRAFFIC.

"Traffic Regulations and the Speed of Motor Vehicles on Highways" was the subject of a very interesting paper read by R. E. B. Crompton (the well-known electric engineer) at a meeting of the Automobile Club of Great Britain on Wednesday, the 13th inst. The paper was of a most exhaustive kind, and one of Mr. Crompton's main conclusions was that to deal with the ever increasing traffic in London it would be necessary not to limit the speed allowed, but rather to increase the maximum—in fact, that in future regulations, instead of restricting the speed, they ought to be based on the distance within which the vehicle can be pulled up in case of an emergency. The author showed that about 30 ft. is required in which to stop a hansom cab going at 12 miles an hour, and that a properly braked automobile driven at the same speed could be pulled up to a certainty within 15 ft. and a cycle fitted with modern brakes in 10 ft.

"Suitable Speeds for Motor Vehicles, with Due Consideration for Size, Weight and Local Conditions Under Various Circumstances" is the subject of an essay competition just inaugurated by the Automobile Club of Great Britain, the prize being a sum of $50. The decision as to which is the best essay will rest with the club committee. An essay must not exceed a thousand words and must be in the hands of the committee by Thursday, Feb. 1.

THE MOTOR TRADES ASSOCIATION.

A second meeting of the recently formed Motor Trades Association was held on Wednesday afternoon, when Harry J. Lawson was elected first president and an executive committee was chosen. The formation of the association, or rather the connection of Mr. Lawson with it, has given rise to much misgiving, and the meeting on Wednesday was not altogether plain sailing. After Mr. Lawson was elected president a discussion took place, as a result of which one gentleman asked for an assurance from Mr. Lawson that the resolution appointing him to the chairmanship would be withdrawn. This, however, was not given, but the chairman intimated that he would leave the matter with the committee. The main object of the new association appears to be the controlling of exhibitions, but what the outcome of it all will be remains to be seen. The fact remains that the peace of mind of the motor manufacturer in England is just now being greatly disurbed one way and another.

The completeness of the report prepared by the surveyor on the bids sent in for the supply of motor vans has apparently come as a surprise to the Chelsea Vestry, which has decided to postpone the consideration of the report until February next. In the meantime the surveyor is to take such action as he thinks proper to glean further information about the particular vans tendered for, so that when the Vestry reassembles after the recess it may hope to have a full education on the subject.

"Heavy Motor Lorries for Liverpool Traffic" was the subject of a paper read by Arthur Musker before the Liverpool Engineering Society last night, the 13th inst.

COMMUNICATIONS.

Storage of Gasoline.

New York, Dec. 19.

Editor Horseless Age:

I have carefully read each issue of The Horseless Age in the hope of finding an article dealing with the storage of gasoline in bulk in this city.

It is the intention of this company to establish a repository for automobiles, where owners of various types of vehicles can store them at a moderate monthly rental. It is of course positively necessary in such an establishment that the owners of vehicles should have charging facilities for electric vehicles and be able to purchase gasoline in such quantity as they might desire. There is no trouble in getting permits for putting in the necessary equipments for the charging of storage batteries. I have, however, run across a number of obstacles in securing the rights from property owners for storing gasoline in quantity on the premises. I have given this subject considerable study and find a great difference of opinion held by various parties I have spoken to on the subject. There is a specially constructed iron tank built for the storage of gasoline by a well-known New York concern, the size of which is 30 x 36 in., holding about 108 gals. I have shown the drawing of this tank to Inspector Murray, Chief of the Board of Combustibles of this city, who stated to me that he would willingly give me a permit to place this tank 4 ft. under the ground inside the curb line, in several places I have looked at as suitable for storing automobiles, provided the Highway Department would permit the opening of the pavement. The Highway Department demand that a vault shall be built, in which the tank could be placed. Of course, before securing either of the above permits the consent of the property owner must be obtained.

Prominent insurance men and the Board of Fire Underwriters claim that the placing of such a tank in the position above referred to would necessarily increase the rate of insurance on not only the property on which the tank was placed, but on the adjacent property. Several owners of property whom I have consulted claim, after consultation with their attorneys, that should they permit the placing of this tank on their property they would be personally liable, in the event of any explosion, for personal injury as well as for any damages to the property on both sides of the street for the entire block.

These statements seem rather peculiar when we know that stationary gasoline engines are being operated in several places in this city which must necessarily require some 40 or 50 gals. to be kept on the premises. Paint stores frequently carry a barrel of gasoline, as do scouring and cleaning establishments. Of course these people may assume the risk of explosion as well as take their chances of imprisonment, in case they are caught. You can readily see, however, that if an automobile repository were established, as we propose, it would naturally be known to the public, and in a very short time, unless the necessary city permits were secured, the city officials would be down on us, if any quantity of gasoline was stored on the property.

As a matter of fact, about 70 per cent. of the automobiles now used in New York by private individuals are operated by gasoline, and as the number of these vehicles is daily increasing, some provision must be made for getting fuel.

You will recall when electricity was first introduced as an illuminant that the fire underwriters positively prohibited the running of electric wires in buildings. In a short time they demanded that all wires run in buildings should be suspended and fastened to porcelain knobs or insulators, with the wires exposed. To-day an exposed wire is rarely seen.

Gasoline properly handled is no more dangerous than our regular illuminating gas, and surely some law or ordinance should be available under which owners of vehicles may be able to get a supply.

I should like to have the experience of some of your readers on this subject, and think the matter is of sufficient importance to warrant a thorough investigation with a view to securing necessary legislation, in which I will be pleased to co-operate. Very truly yours,

THE METROPOLITAN AUTOMOBILE BAZAAR.
William Hazelton, General Manager.

An Old-Timer.

Everett, Mass., Dec. 18.

Editor Horseless Age:

In the year of 1866, when the old velocipede fever was on in Boston, I built a very successful steam road carriage, of which the following is a brief description: It had a pair of reciprocating reversible engines, with 3 x 6 in. cylinders. The engines were secured in a horizontal position upon the frame or perch of the carriage, acting upon the crank shaft, which had a pinion gear, geared into a large spur gear, secured to the hubs of the rear wheels. The boiler was built on the plan of an Amoskeag fire engine boiler. It was 18 in. in diameter and 30 in. high, and rested upon springs on the frame back of the carriage body. Under the seat was a water tank holding 15 gals. of water, with a fuel box. The steering was done by turning the forward axle and wheels. A rack was attached to the axle, running through a rack box gearing into a small pinion, upon the end of a shaft extending up in front of the seat with a crank upon the top to operate the same. This method of steering was as good as any now in use. The axle being pivoted in the center, allowed the forward wheels to adjust themselves to all unevenness in the roads and prevented the twisting of the carriage.

I have now invented a very rapid generating steam boiler for use in vehicles and elsewhere where a large amount of steam is required to be made very rapidly. It is a water tube boiler, has no shell, and is so constructed that a large pressure of steam can be carried with perfect safety. It can be built in any shape—square, round or oblong. When ready to fire up, it contains 3½ gals. of water and has 14 sq. ft. of heating surface exposed to each gallon of water. The feed is automatic.

L. D. SHAW.

Words of Commendation.

Montreal, Dec. 19.

Editor Horseless Age:

I feel so much pleased with the Steam Boiler Number that I think it is only due to the management, editors and contributors to express my appreciation of the enterprise and good judgment evinced in giving us such an interesting and valua-

ble issue, particularly at a time when so much attention is being directed toward the development of steam motors for this purpose.

I must also commend the position taken by the editors in their just and fearless criticism of the fakirs and freaks. This is a critical period with the industry, and it is certainly of great importance to all concerned to have a medium so fair minded, progressive and withal conservative and reliable to point out the way, and through which may be voiced the best thought and endeavor of the workers in this new field.

Of the many good features in The Horseless Age, I think there is none of greater value than the foreign review which from week to week gives us so clearly the status of the industry in other countries, enabling those on this side of the pond to gauge their own work. After carefully following these reviews, I am of the opinion that Americans will yet take the lead in this industry, as they always have when originality and skill are prime factors. It appears to me that steam will play a most important part in the automobile of the future, and I am satisfied that it will find its most perfect expression through American work. Yours sincerely,

JAS. A. WRIGHT.

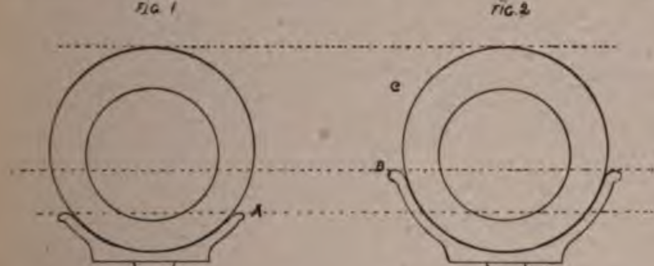
Suggestions in Rim Construction.

Hamilton, Ont., Dec. 8.

Editor Horseless Age:

The tire question is admittedly one of the greatest problems in motor carriage construction. It seems to me that if tire makers would use a shallow rim, as I have shown in Fig. 1, instead of as shown in Fig. 2, it would give from 30 to 40 per cent. more cushion and for the same reason extend the life of the tire. In Fig. 2 there is too much dead rubber and the binding has to take place between the points B and C, and the

FIG. 1 FIG. 2



short nipping process in that small space causes the rubber to separate from the canvas and lumps soon commence to show, and when these puncture it is impossible to find the leak, as the air will come from any part of the tire. Fig. 1 would give far more cushion and consequently better service, and if properly cemented and bolted on could not come off. In writing this my only desire is to help others to get a better rim and tire and thus assist the motor carriage business.

W. G. WALTON.

The general idea is that Fig. 2 would afford greater surface to withstand the strain of side slipping, as it is termed. It seems to the writer that if the rim circle in Fig. 2 be struck with a longer radius than the tire the object of Fig. 1 would be attained, and yet, when under compression as well as side slip, the tire walls would receive due support, as in Fig. 2.

R. I. C.

Oil Fuel Burners.

Chicago, Dec. 12.

Editor Horseless Age:

I have read with much interest in the Dec. 6 issue of your valuable paper an article from the pen of R. I. Clegg treating on oil fuel burners.

The art of burning crude oil as a fuel is ancient, but to carry out this art with safety as well as economically is not easy. We have made great improvements in burning oils. The fuel oil injectors are about as perfect as can be made, and on large boilers fill a long-felt want where great quantities of coal had to be handled, to say nothing about the cleanliness of the boiler room. The use of oil as a fuel on steam boilers for automobiles, however, is the question before us. We certainly can hardly follow in the path of the principles used on large steam boilers. Steam plays a very important part in oil injectors, and to use the steam oil injector on a small boiler I fear would be a little expensive as well as hard on the delicate boiler. Mr. Clegg's box burner, as he calls it, comes in very nicely for these small boilers. Being familiar with both injector and box burners, I may be able to assist my fellow readers along this line, but before proceeding on the box burners I will return to the injector shown in Mr. Clegg's article, marked Fig. 1. The injector, if I read the article right, uses gasoline, and to heat the burner before starting a teaspoonful of oil is put into the reservoir h, and, of course, ignited. I want to call attention to this one point on starting this burner. It is very dangerous to handle this oil in the manner suggested. I am writing this from experience, and with every care that could possibly be thrown around the machine that was using the oil, I suffered for the experience I gained. I used gasoline to heat the generator until I was driven to find a substitute, which I did, and so got rid of the danger. If this injector burner must be used on small boilers (and I don't see why they should be used), heat the injector with carbureted air and do away with at least this one danger.

Regarding box or oil burners, I have found them without an equal for heating hot water boilers, air furnaces and boilers up to 10 h.p. They are absolutely safe and burn a grade of oil (Paragon) away below the flash test of ordinary coal oil. Of course, gasoline, naphtha, benzine or any of the lighter oils can be used in this burner, but it is unnecessary as well as expensive. Paragon oil will cost about the same as crude oil, is clear amber in color and flows freely. A match thrown in it will not ignite it, so low is the flash test. The burner is fed from a tank placed at any distance desired, and with the tank having a pressure of from 5 to 10 lbs. on it there is little or no carbon in the flame, and an intense heat. The flame can be regulating by supplying more or less oil to the burners, which is done by turning a needle-point valve. These oil burners generate their gas about the same as the box burners shown by Mr. Clegg, but the ones I have made and used are constructed a little different, the fine stream of vapor drawing air with it before striking the plate provided and spreading. The burner proper remains always in the center with the flame under and all around it.

This class of burner is not an experiment, but has been used as a commercial article for some time. I believe it is the best burner I have seen for small boilers. Its cost is small, also setting up of same, and it is not dangerous either in itself or in the oil used.

Should I find time I will give a detail drawing of the working of these oil burners; also the substituting of carbureted air for gasoline in starting generators or injectors where gasoline is used.

When an oil box burner is generating a perfect vapor (that is without carbon) the interior of the fire box can be whitewashed, and after running 24 hours not a speck of discoloration or carbon should be seen, so perfect is the combustion.

DANIEL D. GRIFFITHS.

We shall be pleased to receive the drawings from our friend and trust they will fully bear out his statements.

The amount of gasoline required to heat a burner at the start is very small and dependent, of course, upon the size of the casting, etc. The method we descirbe is in common use by plumbers, electricians, etc., and we have not found it particularly dangerous. A novice who should start the flame and at the same time stand over it would be liable to injury from the extent and rapidity of the blaze. Our experience in the design and manufacture of oil burners is long and varied. Knowing something of the dangers, we did not hesitate to call attention to blemishes in burner design, and we shall continue to commend any device that shall lessen the opportunities for misfortune; on the other hand, the lighter oils are safely handled in thousands of homes, and we should not be too prone to unnecessary cautiousness. R. I. C.

A Chance for the Automobile Club.

St. Louis, Mo., Dec. 23.

Editor Horseless Age:

Knowing that your readers will be interested in a suit for damages filed against me by parties who claim that my automobile frightened their horse, I herewith inclose a clipping from the St. Louis Republic of Thursday, Dec. 21.

I desire to state that this description of the accident is erroneous in several respects, as follows:

First—The statement that I was unable to properly control the vehicle is not true.

Second—That it ran dangerously close to the buggy is not true, as the automobile was promptly stopped as soon as the horse began to prance, and it stopped at least 100 ft. from the horse.

Third—The statement that I had already taken occasion to deny that I had anything whatever to do with the vehicle which frightened the horse is not true.

Before bringing this suit they had accused me of colliding with their buggy and smashing it, and also had published in the papers a statement headed "The Automobile as a Juggernaut."

In conclusion I suggest that you hand this letter to the attorney for the Motor League, so that he may co-operate with me in the defense of this suit.

If you desire any further information I will be pleased to furnish same. Fraternally yours,

JOHN C. HIGDON.

The clipping inclosed reads as follows:

Three suits for damages were filed in the St. Louis County Circuit Court yesterday against John C. Higdon, a St. Louis patent attorney. Two of the suits were filed by Theobald Anselm for himself personally and as next friend to Annie, Albert and Alice Pauli, while the third was filed by his wife, Mrs. Katherine Anselm.

In the petition filed it is alleged that on Sept. 21 last the defendant was riding along the Olive St. road near the Wesleyan Cemetery in an automobile or motor vehicle, when he met Mrs. Katherine Anselm and Mrs. Katherine Pauli, her daughter, driving west from St. Louis. It is set forth that the defendant was unable to properly control the vehicle and that it ran dangerously close to the buggy driven by the two women, causing their horse to shy in such a manner that they were thrown out of their buggy. The petition alleges that Mrs. Pauli sustained internal injuries at the time, from which she never recovered, dying nine days later.

Annie, Albert and Alice Pauli were children of Mrs. Pauli, and as their maternal grandfather and next friend, Mr. Anselm asks $5,000 for his daughter's death. In his second petition he asks for $300 damages to his buggy and horse. In the third petition, which was filed by Mrs. Anselm, the plaintiff asks for $2,000 on account of the injuries that she sustained.

The filing of the suit has caused considerable interest among motor vehicle promoters, not only in St. Louis but in other places as well, as upon its outcome the responsibility of owners of the horseless carriages will be defined. Mr. Higdon has already taken occasion to vigorously deny that he had anything whatever to do with the vehicle which is said to have frightened the Pauli horse.

The attorney for the plaintiff is just as insistent, however, that he was the occupant of the vehicle. He says that at the time the ladies were thrown out of their vehicle the driver of the automobile made no attempt to stop, but a passer-by at the time whipped up his horses and followed him to his home, at No. 5561 Von Versen Ave., thereby learning his identity.

QUESTIONS AND ANSWERS.

At the request of many of our readers we have decided to open a department of questions and answers. We will endeavor to answer any detail question in practical engineering pertaining to motor vehicles.

Cylinder Cooling by Radial Ribs.

New York, Dec. 4.

Editor Horseless Age:

Will you kindly furnish me with the following information: Many others of your readers will, I think, be also interested, especially those who are trying motor building on the "cut and try" plan:

What is the largest size cylinder which can be kept sufficiently cool by radiating ribs?

Are there any illustrated books published on building small explosion motors? If so, what are the titles?

JOHN H. CURTIS.

1. We have no data from which this matter can be accurately determined.

2. Good practical handbooks on the subject are rare; probably Grover's "Modern Gas and Oil Engines" would be of material help to you. R. I. C.

Refer to Horse-Power Tables.

Brooklyn N. Y., Dec. 12.

Editor Horseless Age:

Would a 1½ h. p. gasoline motor (weight 140 lbs.) be sufficient to propel a runabout (weight 400 lbs., including engine) geared back 3 to 1, 28-in. wheels being used?

A. WALLACE.

Please refer to horse-power tables in past volume. These are for most favorable circumstances and to the theoretic amount you must add for the shortcomings of road and motor. R. I. C.

OUR FOREIGN EXCHANGES.

Balancing of Motors.

By H. E. Wimperis, Wh. Sc.

II.

The balancing of wheels, shafts and all simply rotating pieces is not difficult. It is first necessary to arrange that the center of gravity of the wheel lies in the center of the shaft, and this can be, and often is, done by putting the wheel on a short spare length of shafting and allowing it to roll upon two level straight edges set up on trestles, and cutting parts of the back of the rim away till the whole wheel and shaft rests indifferently in any position. This by itself, however, is not enough, unless the machinery is very slow speed. In cases of high speed machinery the balancing must be done at high speed, and if there be a lack of material on one side of the wheel, the excess of material on the other edge of the wheel must be removed, so that no twisting couple is induced. Thus in Fig. 3, if the wheel be perfectly balanced by itself, and two equal masses, A and B, are fastened as shown, the wheel would still rest in any position, but on rotating two equal forces (due to centrifugal action), F_1 and F_2, would come into play, and tend to twist both wheel and shaft till the line joining A and B was perpendicular to the axis of rotation.

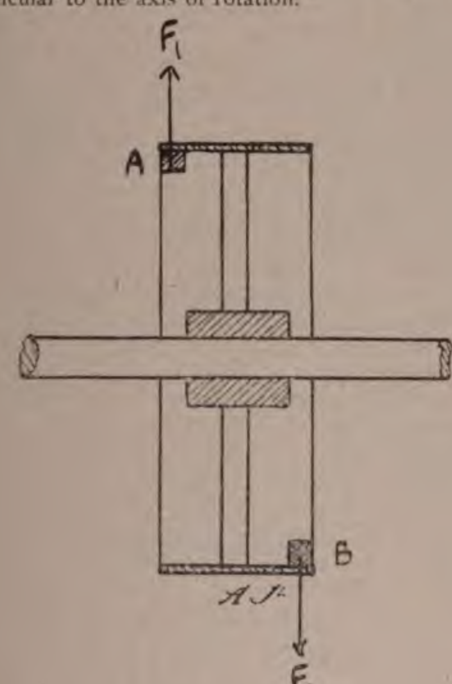


FIG. 3.

When there are two wheels and two cranks on the same shaft, as in a locomotive, balance weights are fixed into both wheels, so that no twisting action of the kind referred to above will occur. In connection with this it must be remembered that for any bodies to be in equilibrium we must have—

1. Forces resolved in any direction balance.
2. Couples about any axis balance.

These two laws cover all cases that arise. It may sometimes occur that the numerical work in finding whether forces balance by the two rules quoted above is laborious, and in that

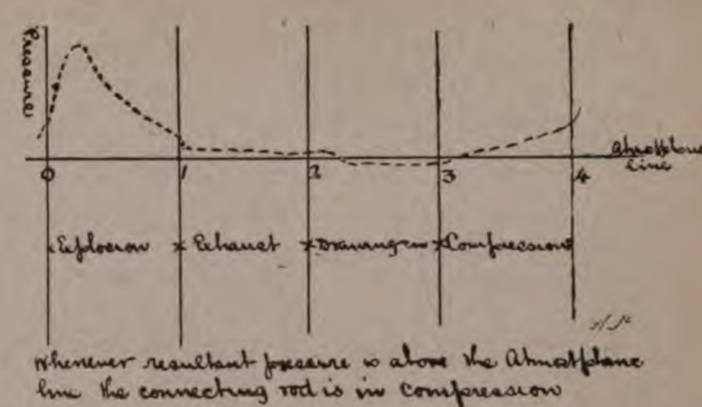


FIG. 4.

case we have resort to graphical methods. The graphical conditions of equilibrium are that, first, the force polygon is closed, and, secondly, the link polygon is also closed.

In the previous article the writer mentioned the fact that it is possible to replace a horizontal oscillation by a vertical one and vice versa. As an example we may consider the case of a single-cylinder unbalanced engine working vertically between two fly wheels. On turning the engine round it will, of course, always be found that, owing to the weight of the piston, connecting rod, etc., the crank will always come to rest in the lowest position, and upon running the engine fast it is found that considerable vertical vibration is induced; while if we first balance the engine with equal weights on each fly wheel (supposing them to be equidistant from the crank), so that the crank comes to rest in any position indifferently, and then running the engine, it is found that the vertical vibration has been stopped, but has given rise to an equal horizontal one. The reason for this is not difficult to see. The centrifugal force of the balance weights can be split up into two equal component forces at right angles, one vertical, and equal to the inertia forces of the piston, connecting rod, etc., the other a horizontal one, with nothing to balance it. Hence the vibration.

To show this it is only necessary to take the weight of piston, connecting rod, etc., as W, and the sum of the weights of the two balance weights as w, then if length of crank arm = a and radius of the fly wheel = A,

It follows that by the principle of leverage or by taking moments about the crank-shaft $w . A = W . a \therefore w = \frac{a}{A} . W.$

Also, as in last article, the acceleration force of the piston (neglecting obliquity of connecting rod) was shown to be $\frac{W}{g} . \frac{v_1^2}{a} . \cos \theta$, while the centrifugal force of balance weights $= \frac{w}{g} . \frac{v_2^2}{A}$ where v_1 is velocity of crank and v_2 of periphery of fly-wheel. Now, this centrifugal force of the balance weights can be split up into $\frac{w}{g} . \frac{v_2^2}{A} . \cos \theta$ vertically and $\frac{w}{g} . \frac{v_2^2}{A} . \sin \theta$ horizontally, and since $\frac{v_1}{a} = \frac{v^2}{A}$, therefore the vertical component of this centrifugal force

$$= \frac{a}{A} . \frac{W}{g} . \frac{A^2}{a^2} . \frac{v_1^2}{A} . \cos \theta.$$

$$= \frac{W}{g} . \frac{v_1^2}{a} . \cos \theta.$$

And this is exactly the same as the force due to the acceleration of the piston, etc., and as they are in opposite directions, they balance each other and only the horizontal component is left.

This investigation shows how a motor car builder can, if he wishes it, convert all or any portion of a horizontal vibration into an equal vertical one, and vice versa. It is not difficult to think of circumstances in which this power would be useful to him. While on the subject of vibration, one would do well to pay attention to such things as knocking in bearings, such as the big end of the connecting rod. The pressure behind the piston (i. e., on the far side from the crank) of a gas engine is not always greater than the pressure of the atmosphere, and as this is so, it follows that the big end is not always kept pressed against the crank, but at certain points it changes from a push to a pull, as in Fig. 4, which represents an indicator card taken by the writer from an Otto gas engine working at about 4 i.h.p. The card is folded out so as to give the pressure behind the piston for each part of the cycle of two revolutions. It will be noticed that the pressure is below atmospheric between the second and third stroke of the cycle.

Evidently the inertia forces due to piston, connecting rod, etc., will modify this diagram, but in the case of a cycle that it takes four strokes to complete it is almost unavoidable but that the connecting rod should change from compression to tension and back again, and this is the sort of thing that causes knocking. It is therefore important that the bearings be not slack; it will be remembered that in the Willan's engine the double acting principle is discarded in order to avoid knocks at high speed. The effect of inertia would lower the curve at o and 4 and 2, and raise it at 1 and 3.—Automotor.

(To be continued.)

An Early English Motor Vehicle.

We introduce to the notice of our readers a view of Dr. Church's steam carriage in actual operation in England. This carriage is spoken of as one of the likeliest to be attended with success. The picture is a reduced copy from a very handsome engraving, recently published here by an artist of the name of Lane. In the cases of Gurney, Heaton Brothers, and also, I believe, Sir Charles Dance, there is one carriage to carry the engine and another the passengers. These locomotive machines, in short, are drags, merely meant to be used in the same way as Jonathan Hall, in the infancy of steam navigation, proposed to use steam tugs. Dr. Church, on the contrary, has but one carriage for both machinery and passengers. The one represented in the drawing is built to carry 50 passengers. The wheels are about 6 in. broad in the tire and 8 ft. in diameter.

The crank shaft, worked by the cylinders, is connected by endless chains with the axles of the hind wheels of the carriage, and each wheel has a separate axle. The spokes of the wheel are so constructed as to operate like springs to the whole machine—that is, to give and take according to the inequalities of the roads. The boiler consists of a series of double tubes, one within the other, placed in a vertical position around a circular fireplace, and communicating with it; the heated air passes through these tubes, which are everywhere surrounded with water.—Mechanics' Magazine.

The Grant Roller Bearing.

We introduce in our advertising pages a new maker of roller bearings—i. e., new to the readers of The Horseless Age—the Grant Axle & Wheel Co., Springfield, O. The roller bearing they manufacture is built on entirely different lines from all others in the market, the end thrust being taken care of by the conical rollers themselves instead of by an additional ball bearing, as is often employed for this purpose. The bearing is oil and water tight, requiring oiling but three or four times a year. The adjusting nut is so constructed that the least particle of wear can be taken up in a moment's time. Another advantage is a loose cone, so that an occasional jolt or jar will cause the cone to turn and bring the wear upon another part of it instead of concentrating all the wear on one part, as is the case when the cone is keyed to the spindle.

The Grant bearing is used in various ways to reduce friction, with good results on the axles and motors of motor vehicles. For motors, etc., the outer shell or casing is made differently. This part can be made in any style to meet the requirements. They build these to fit shafts of the following diameters: 1⅛, 1¼, 1½, 1¾, 1⅞, 2¼, 2½, 2¾ and 3 in. Where it is necessary to use a sleeve on the shaft it will reduce the diameter of the shaft accordingly.

The Grant Co. claim a saving of from 33 1-3 to 40 per cent.

Willard Automobile Storage Battery.

Sipe & Sigler, Cleveland, O., manufacturers of the Willard storage battery, have issued a very complete booklet devoted to their automobile batteries alone.

The Willard plate, including the terminal, is constructed from a single sheet of pure rolled lead, every part of the finished product remaining integral with the original plate, never having been separated therefrom. On either side of the sheet of lead there are formed thin horizontal leaves or shelves about ¼ in. wide and 1-32 in. thick. These leaves remain attached to a web or support in the center, and incline upward with a curve at an angle of about 20 deg., thus forming a uniform cup-shaped opening between them.

The active material is produced by electro-chemical means, uniformly on the surfaces of all of the leaves, and on the surfaces of the web until the insterstices are filled.

One advantage claimed for this battery is that it may be fully charged, if necessary, in 45 minutes, or when entirely discharged it may be charged to 90 per cent. of its capacity in 30 minutes.

"The plates are encased in a special hard rubber jar with a glass cover. The plates are separated from one another by an improved hard rubber separating sheath, which is corrugated, ribbed and slotted in such manner as to create absolutely no extra internal resistance in its use and at the same time to so effectively separate the different elements as to entirely eliminate any probability of short circuits, thereby avoiding all abnormal disintegration. Thus the voltage of a Willard battery for automobile purposes is much higher and much more constant than that of any other make of battery."

The glass cover permits an examination of the interior of the cell at all times and keeps in view the electrolyte, which is of great importance in batteries used for this purpose, as in cells without the glass cover great damage frequently occurs

through the unnoticed evaporation of the electrolyte below the tops of the plates.

Sipe & Sigler propose to make a specialty of maintaining at a stated sum per annum and for a period of years all Willard batteries in whatever make of carriage used. This contract will be made direct with the owner of the carriage.

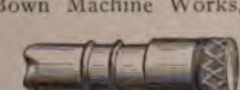
Hydraulic Tire Inflator.

To meet the demand for an hydraulic air compressor that will supply air in sufficient volume and pressure to fill the tires that are to be inflated in an up-to-date motor vehicle store or for private users, The L. E. Rhodes Co., of Hartford, Conn., have brought out a special compressor. The compressor consists of two cylinders with a common piston rod. One of these cylinders is supplied with water under the ordinary city pressure, supplying power to move the piston and compress the air in the second cylinder. The ordinary small air compressor, intended really for a beer pump, does not supply air sufficient either in pressure or volume for tire inflating and is not adapted to work economically.

The Hartford Mammoth Air Compressor, as it is called, is made in a great many different sizes and it is possible to select the combination of the various sized air and water cylinders which will make an efficient and economical machine for the particular conditions of water pressure available and the compressed air needed in each case. The manufacturers state that persons wishing to inquire into the feasibility of such a machine for their use should write giving the water pressure in their place with the size of their supply pipe and their estimate of the number of tires to be inflated per hour.

Bown Automatic Tire Valve.

A new, simple and quick acting tire valve is being manufactured by the Bown Machine Works, Battle Creek, Mich.



There is said to be absolutely no mechanical resistance to overcome in filling the tire, and the ball valve acts instantaneously, preventing the outflow of air after each stroke.

The Woodruff Patent System of Keying.

Methods of keying fly wheels, gear wheels, etc., are of interest to manufacturers of motor vehicles. A comparatively new system, which is rapidly making its way, is the Woodruff, controlled by the Whitney Mfg. Co., Hartford, Conn. It does not require skilled labor, the key reaches deeper into the shaft and is therefore capable of standing greater strain, and it cannot roll over in its seat. Manufacturers using this system report a saving of 75 per cent. in some cases.

Key seating under this system can be done on any milling machine, but the Whitney Mfg. Co. recommend their Universal hand milling machine for this purpose.

MINOR MENTION.

A Saxon Automobile Club has just been formed in Dresden to promote automobilism in Saxony.

The Pathfinder Mfg. Co., Chicago, Ill., has been formed with $2,500 capital to manufacture automobiles.

The Belgian Automobile and Cycle Show will be held at Brussels during the first week in April at the "Pole Nord."

D. C. Luce, formerly of North Attleboro, Mass., has taken the superintendence of the Beach Motor Vehicle Co.'s factory, Everett, Mass.

The Automobile Club of Chicago has been organized by J. O. Armour, E. W. Herrick, Samuel Insull, F. K. Pulsifer and Andrew R. Sheriff.

A verdict of $2,750 was recently given against the Altham International Motor Co., Boston, Mass., in an action brought by Joseph M. Cox for breach of contract.

The Standard Automobile Co., $1,000,000 capital, has been organized at Chicago, Ill., by M. C. Alford, Lexington, Ky.; T. C. H. Vance and J. Huppaker, of Louisville, Ky., and H. W. White and J. M. Wier, Chicago.

Among the new members proposed at the last meeting of the Automobile Club were Sir William Van Horn, president of the Canadian Pacific Railroad; G. Creighton Webb and Frederic Nicholls, president of the Northern Railroad.

The Bicycle Trust has removed some of the machinery from the plant of the Indiana Bicycle Co., Indianapolis, Ind., for the Canadian branch of the Trust, and will devote the Indiana factory exclusively to the manufacture of automobiles.

James Henry Sager, of the Sager Mfg. Co., Rochester, N. Y., has opened a motor vehicle agency at 25 South Water Street, that city, under the name of the Regas Vehicle Co. He will represent the Waltham Mfg. Co. and the Woods Motor Vehicle Co.

The Haynes-Apperson Co., Kokomo, Ind., speak in high terms of the Nungesser 1900 dry cells for starting gasoline vehicle motors, sold by L. H. Allen, 2427 Michigan Ave., Chicago, Ill. They use eight cells, which with proper care they have found will last a year. They have run their carriage 50 miles on eight of these cells without the aid of a magneto.

MOTOR VEHICLE PATENTS of the world

UNITED STATES PATENTS.

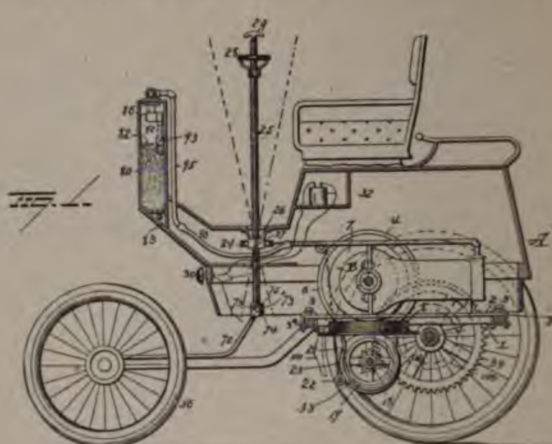
No. 638,331—Dec. 5, 1899—Motor Vehicle.—W. W. Grant, of New York, N. Y.

Fig. 1 is a sectional elevation. Fig. 2 is a plan. Fig. 3 is a controller for regulating direction and speed as well as operating the gong. Fig. 4 is a transverse section showing gearing. Fig. 5 is a rear end view of the apparatus, partly in section. Fig. 6 is a detail view of hub construction.

Two wheels, 4 5, are secured to the motor shaft and parallel with each other. The wheel 4 is made with a groove for the reception of a shoe, 6, of leather, and to one face of wheel a ring or plate, 7, is secured. A friction wheel, 8, is disposed in a horizontal position under the frame 2, and provided with a hollow boss, 9, for a bushing and for the passage of a screw, 10. The screw 10 is locked at its upper end in a hole in the frame 2 by means of a key, 11, and is provided at its lower end with a large head, 12, in a countersink, 13, in the friction wheel 8, said countersink being of such depth as to leave a space under the head of the screw to form a recess, 14, in the under face of the friction wheel at the center thereof. The friction wheel 8 is also provided with an upwardly projecting annular flange, 15, near its periphery. The peripheral shoe, 6, of wheel 4 has frictional contact with the upper face of the peripheral portion 16 of wheel or disk 8, and the periphery of the ring or plate 7 on wheel 4 has frictional contact with the top face of the anular flange 15. By this construction and arrangement of parts motion will be transmitted from the wheel 4 to the wheel or disk 8, and the running of one of said wheels on the other will tend to be noiseless. The diameter of the wheel or disk 8 is apreciably less than the space between the wheels 4 and 5, and between the annular flange 15 of wheel or disk 8 and the side face of the wheel 5 an idler, 17, is disposed. The idler is preferably made of rubber or other frictional material (or a wheel covered with such material, and is suitably mounted on a stud depending from the frame 2. Thus the wheel 5 and idler 17 will co-operate with the wheel 4 in imparting motion to the friction wheel or disk 8. The peripheral flanges of the wheel or disk 8 may also be faced with frictional material if desired. The face 16 and the peripheral face of flange 15 may be faced with frictional material when so preferred, whereupon the shoe 6 of wheel 4 may be omitted.

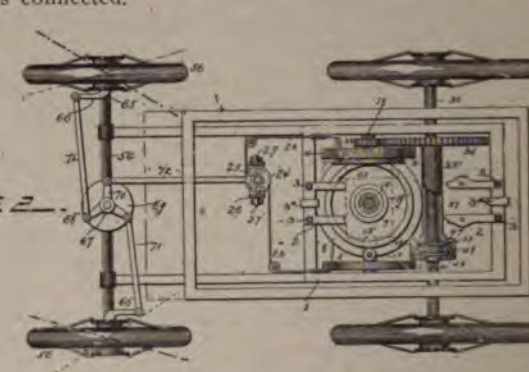
A shaft, 18, is mounted in suitable bearings supported by hangers depending from the frame 1, and to this shaft a drum, 19, is secured so as to be disposed beneath and parallel with the under face of friction wheel or disk 8, and a short distance therefrom. A comparatively narrow strap, 20, of frictional material encircles the drum and is adapted to bear against the under face of wheel or disk 8, thus forming a frictional connection between the drum 19 and said wheel or disk, whereby motion will be transmitted from the latter to the former. The relation between the drum 19 and friction wheel or disk 8 can be readily adjusted and regulated by raising or lowering the

FIG. 1.



frame 2, on which the friction wheel is mounted, by means of the set screws 3. A shipper, 21, loosely embraces the drum 19 at respective sides of the strap 20 for the purpose of shifting the latter on the drum, and thus regulating the speed of the drum and of the vehicle, with driving wheels of which said drum is connected.

FIG. 2.



A beveled pinion, 47, is secured on the axle 36 (within the housing), and a similar pinion, 48, is secured to the sleeve 41. Two other pinions, 49 49, are disposed between the pinions 47 48 and mesh with them. The pinions 49 are mounted on shouldered pintles, 50, projecting from a collar, 51, mounted on the axle 36 and sleeve 41 at the abutting ends thereof. The ends of the pintles 50 have bearings in grooves, 52, made in the inner peripheral wall of the housing, the inner sides of said grooves forming shoulders which receive the thrust of said pintles. By the provision of the grooves 52 the collar 51, pintles 50 and pinions 49 can be readily inserted within the housing, the latter being then closed by an end plate, 53, having a central hole for the accommodation of the hub of pinion 48. The outer ends of one or both the pintles may be threaded, and about the inner ends of the grooves 52 the peripheral wall may be drilled or tapped for the passage of a cap or nut to be secured upon end of pintle, thus providing a greater and stronger side thrust bearing through the thus lengthened pintles.

The front axle 54 of the vehicle is rigidly secured to the frame work, and the hubs 55 of the front steering wheels are mounted to revolve at the respective ends of said front axle and to be pivotally connected therewith. One head of each hub 55 may be made integral with the peripheral portion thereof, and the other head, 57, is preferably screwed therein and secured by suitable set screws.

Fig. 3

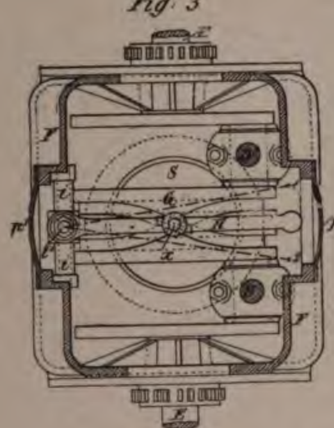


Fig. 2

Fig. 5.

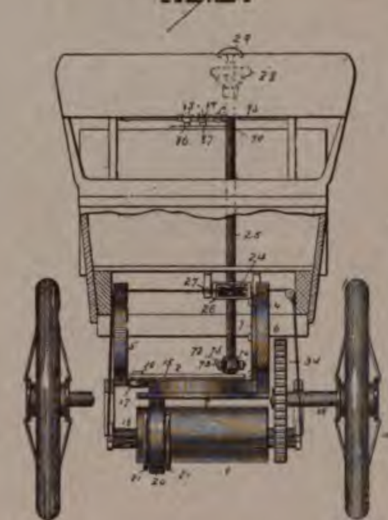


Fig. 3.

Fig. 4.

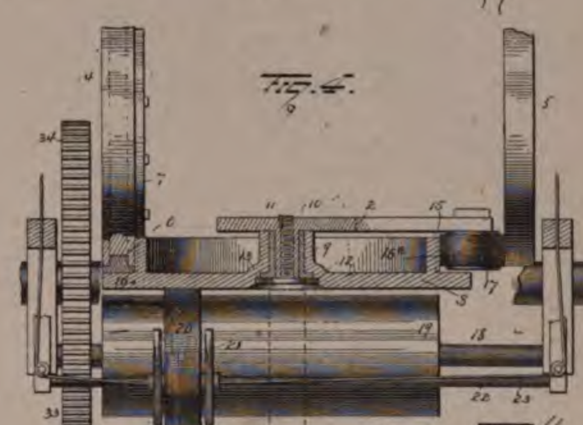
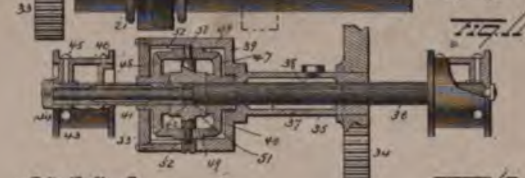


Fig. 11.



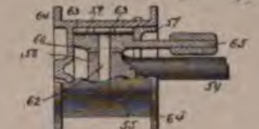


Fig. 6.

Fig. 10.

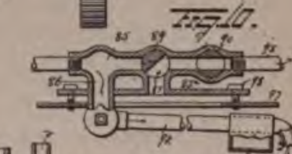


Fig. 9.

It will be readily seen that when the strap 20 is disposed to one side of the center of the friction wheel or disk 8 the drum 19 and the vehicle will be driven forwardly, and when said strap is disposed on the drum to the other side of the center of the wheel or disk 8 said drum and the vehicle will be driven rearwardly, the speed of the drum, and consequently the vehicle, being in either case regulated by the distance of the strap from the center of the friction wheel or disk 8. It will also be observed that when the strap is disposed under the recess 14 in the center of the wheel or disk 8 no motion will be transmitted to the drum and the vehicle can be stopped by shifting the strap 20 to this position. Speed regulation is still further augmented by operation of the dash board controller, through which speed of the motor is controlled.

The shipper 21 is mounted to slide on a rod or shaft, 22, and to the respective sides or ends of said shipper cords or straps, 23, are attached. The cord or straps pass over pulleys suitably disposed, and at their free forward ends are wound on a drum, 24. The drum 24 is secured to a tubular lever, 25, disposed in front of the seat of the vehicle and within convenient reach of the rider. A frame or cage, 26, is mounted on the lever 25 and incloses the drum 24, said drum being provided with a set screw for making it secure and rigid upon and with the lever 25. The frame or cage 26 is provided at diametrically opposite points with trunnions, 27, by means of which the lever is pivotally supported above its lower end in the vehicle. The lever 25 is provided with a hand wheel, 28, by means of which to turn it, whereby to wind one of the cords on the drum 24 and unwind the other cord therefrom, and thus effect a movement of the shipper 21 in one direction or the other. Thus it will be seen that by means of the lever 25 the speed and direction of travel of the vehicle, as well as the starting and stopping thereof, can be readily and accurately controlled by the rider. The lever 25 may also be utilized for the reception of a push button, 29, by means of which to control an electric gong, 30. The push button is made with a shank to enter the upper end of the hollow lever and pass between contact springs, 31, said contact springs being included in circuit with the gong 30 and a battery, 32, the latter being located in a box or casing under the seat or other convenient location upon the vehicle.

The shaft 18, on which the drum 19 is mounted, is provided at one end with a gear wheel, 33, adapted to mesh with and

transmit motion to a gear wheel, 34. The gear wheel 34 is secured on one end of a sleeve, 35, through which the rear driving axle 36 of the vehicle passes. The sleeve has bearings at its ends on said axle, and the space intermediate of said bearings forms an oil chamber, 37, into which lubricant can be inserted through a capped inlet, 38. The inner end of the sleeve 35 is made integral with one end of a housing, 39, and adapted to inclose differential gearing. One end of the axle 36 is contracted in diameter, the shoulder 40 thus formed being located at or near the center of the housing. A sleeve, 41, is mounted on the contracted portion of the axle and may have an end thrust bearing against the shoulder 40; but I prefer to interpose a washer, 42, between the end of said sleeve and shoulder. The hub 43 of one of the rear driving wheels is secured to the outer end of sleeve 41, and the end of the axle is provided with a nut, 44. The hub is also provided with keys or set screws, 45, to enter suitable holes in the sleeve 41. The inner head of said hub is adapted to fit or screw thereinto and is prevented from any possibility of escape or from becoming loose by means of keys or set screws, 46. The hub of the other rear driving wheel is constructed in a similar manner and attached to the opposite end of the axle. If desired, the axle 36 could be made of uniform diameter throughout; but in order that said axle shall present a uniform external appearance the exterior face of the sleeve 41 should align with the exterior face of the larger portion of the axle, and for this reason I prefer to contract that portion of the axle on which said sleeve is located, as above explained.

The front axle is provided at its ends with heads, 58, and encircling each head is a collar, 59, having inwardly projecting bosses, 60, at diametrically opposite points. These bosses are provided with passages, 61, for the reception of pins, 62, passing through the head 58 of the axle, and thus the hubs of the steering wheels are pivotally connected with the ends of the front axle. One end of the collar 59 has a bearing against the fixed head of the hub and its other end has a bearing against the removable head or ring 57. Within the annular space between the peripheral wall of the hub and the collar 59 anti-friction rollers, 63, are disposed and prevented from endwise displacement by the heads of the hub. Each hub is provided with peripheral flanges, 64, to which the spokes of the wheels are secured. Each collar 59 is provided with L-shaped levers, 65, the arms 66 of which project normally at right angles to the axle and in opposite directions therefrom.

A lever, 67, is pivotally mounted on the front axle centrally between the ends thereof, and may consist of a disk having three points of attachment for links or a disk having three strengthening ribs, or it may consist merely of three arms, 68, 69 and 70, integral with each other and pivotally supported at a common point on the axle.

The arms 68 and 69 are connected with the L-shaped levers 65 by means of links, 71. It will be observed that the arms 68 and 69 of lever 67 project laterally from their pivotal connection with the axle and also laterally with respect to the longitudinal axis of the vehicle. In other words, the two arms 68 69 form an obtuse angle, and each arm forms, with the axle, an acute angle, and the arms 66 are of such length as to cause the ends of the links 71 connecting upon the arms 66 to be further away from the axle 54 than are those ends of the links connecting upon the arms 68 and 69, thus throwing the links 71 out of parallel with the axle. From this construction and arrangement of parts it will be seen that when the lever 67 is turned one of the steering wheels will be turned further on its pivotal support than the other, so as to facilitate the turning of the vehicle, the wheel which marks the inner curve on which the vehicle turns being disposed at a different angle to the axle than the wheel which marks the outer curve.

Thirty-one claims. Application filed July 26, 1898.

No. 638,933—Dec. 12, 1899—Electric Generator for Gas Engine Igniters.—Benj. McInnerney, of Omaha, Neb.

Fig. 1 is a side view of a gas engine. Fig. 2 is an enlarged edge view of the generator, and Fig. 3 is a plan view of the permanent magnet.

The generator consists of two parts, the permanent magnet a and the keeper b, and one of these parts is secured in a stationary position upon the engine and the other is movable. As shown, the permanent magnet a is bolted to a part of the frame and the keeper b is carried upon a part of the fly wheel c.

The permanent magnet a is preferably laminated or consists of a series of laminæ or plates, 1 2 3, of any desired number, and in contact with each end of this permanent magnet is a pole piece, d, each pole piece consisting of a series of laminæ

Fig. 1.

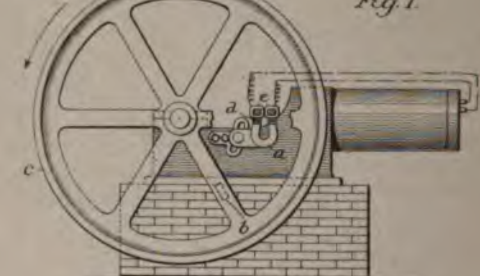


Fig. 2.

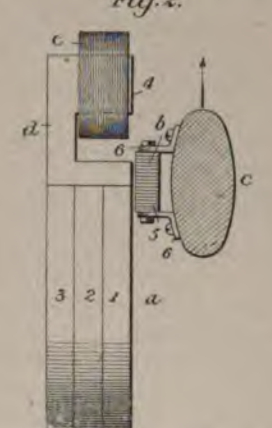
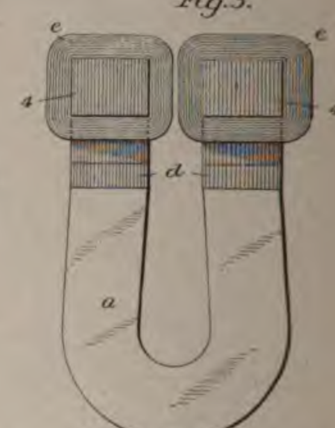


Fig. 3.



which are bent or cut to a U shape, one limb in contact with the end of the permanent magnet and the other limb 4 projecting at right angles to the plane of the permanent magnet and having wound around it a coil of wire, e, which connects with the coil upon the other pole piece and is in circuit with the sparking device, which is not shown, as it may be of any suitable character.

The keeper b may be of any suitable character, but preferably consists of a series of laminæ, 5, connected together between two brackets, 6 6, bolted to the fly wheel at any suitable point.

Heretofore the keeper and the permanent magnet have been so arranged that the keeper first approaches the pole pieces and then travels over the magnet, or the pole pieces alone are presented to the keeper. In the operation of the engine the keeper first travels from the toe or connected end of the permanent magnet toward the pole end. In consequence of this

arrangement there is practically a short-circuiting of the permanent magnet through the keeper as the latter travels over the magnet, which tends to remove the flux from the pole pieces. This lowers the flux in the pole pieces to the lowest practical extent just prior to increasing it to a maximum, so that the rate of increase is very rapid, and the generation of the current depends on the rapidity and magnitude of the change. As the change takes place during the passage of the keeper across the gap between the pole pieces and the ends of the permanent magnet, the time during which the change is developed can be varied by varying the extent of the gap so as to adapt the generator to engines in which there are variations in the timing of the sparking device.

The time during which the generation takes place may be regulated by using pole pieces having different intervals between the ends of the permanent magnet and the pole projections, and the latter may consist of L-shaped pieces instead of U-shaped sections; but the latter form is preferable, inasmuch as the pole piece receives the magnetic flux from each of the laminæ of the horseshoe magnet directly without the flux passing from one of said laminæ to the other and then to the pole piece, which is the case if the latter is L-shaped and only in contact with the lower section of the magnet.

Ten claims. Application filed June 10, 1899.

No. 638,816—Dec. 12, 1899—Driving Mechanism for Autocars.—Georg Erich Sieg, of Kalk, Germany.

This invention relates to a driving mechanism for autocars and the like in which the motor is connected rigidly or on springs with the car body and drives, by means of belts, chains or the like, the driving axle, which cannot share in this spring action. This improved arrangement has for its object the influencing of the tension of the belts by means of springs in such a way that in spite of all the joltings or oscillations of the car body not only does the belt remain constantly taut, but elongations of the belt are compensated for and too great strains on the belt and overloading of the motor by alterations of speed in the same or impediments in the way of the car are avoided. In the present invention this is attained by the arrangement of a peculiar flexible or hinged four-cornered figure which has two spring sides situated opposite one another and two rigid ones and also a rigid diagonal.

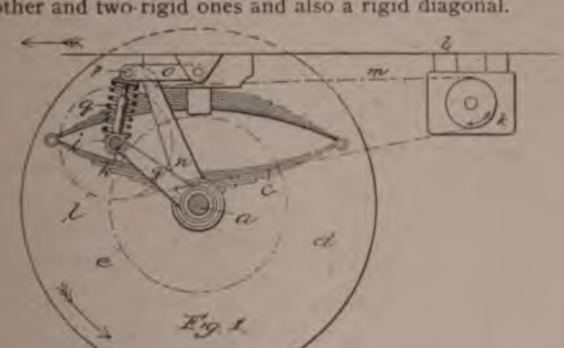
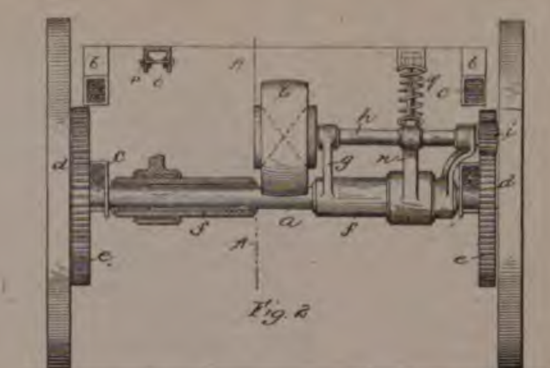


Fig. 1 is a mainly diagrammatic representation of this improved driving apparatus in side view; Fig. 2, a front view of same, partly in section.

The wheel axle a carries springs, c, supporting the car body b. On the end of the said axle the wheels d and cog wheels e, firmly connected therewith, are mounted so as to be freely revoluble. The axle a is also inclosed by two sleeves f, which can also freely rotate on it and in the arms g of which the



shafts h of the pinions i, engaging with the cog wheels e, are mounted. In order that both wheels d may rotate independently one of the other, the shafts h are driven by means of differential gearing l from a motor k, firmly connected with the car body b, which gearing is only shown diagrammatically in the drawings and is at the same time assumed to consist of a belt pulley for the belt m.

As shown in Fig. 1, the shaft h can revolve in a circle around the shaft a, as both are connected with one another by the arms g. The pinions i can thus never come out of engagement with the cog wheels e.

In order to keep the belt or chain m always correctly taut, the following arrangement is adopted: Over the sleeve f, on each side, a freely revoluble arm, n, is placed, which is pivotally connected with the under frame of the car by links, o, carrying a bolt, p. On this bolt p a spring, q, engages, the other end of which is received by a holder or sleeve, r, placed on the shaft h, Fig. 4, and freely revoluble thereon. The arm g, spring q, link o and spring c thus form a flexible four-cornered figure, one diagonal of which is formed of the rigid arm n. This four-cornered figure is attached by one corner to the wheel axle a, and with an adjacent one to the under frame of the carriage. Between the two other corners is located the spring q, which controls the tension of the belt. Instead of the links o any other like vertical guide may of course be employed. On the motor being started and also at each increase in the speed the spring q is first compressed, and thus produces a slight slackening of the belt m, and consequently a transmission free from jerk. The same takes place if the car when running suddenly encounters obstructions like gutter stones (channel stones), or short extraordinarily steep gradients and the like. The slackening of the belt admits of the same slipping slightly, and thereby avoids overloading the motor in the most effective manner. If where electric motors are used the motor is also to be utilized as a brake, the spring q yields when the brake is applied and the belt is stretched more strongly. By this means any slipping which is so dangerous in this case is avoided.

Two claims. Application filed March 8, 1899.

No. 639,160—Dec. 12, 1899—Explosion Motor.—Eugene Fessard, of Poissy, France.

Fig. 1 is a vertical section through a two-cylinder motor. Fig 2 is a vertical section taken at right angles to that in Fig. 1 and passing along the axis of one of the two cylinders. Fig. 3 is a horizontal section taken upon the line 3 3 of Fig. 1. Fig. 4 is a plan view, as seen from above, of the end of the two cylinders of the motor.

A and A' are the two cylinders, which are surmounted by the cylinder ends B and B', each of which comprises an ad-

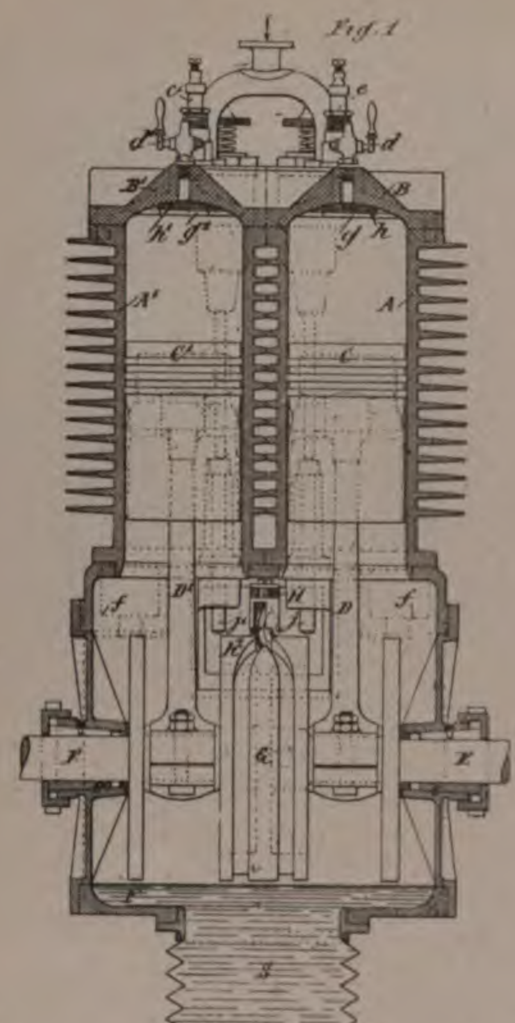


Fig. 1

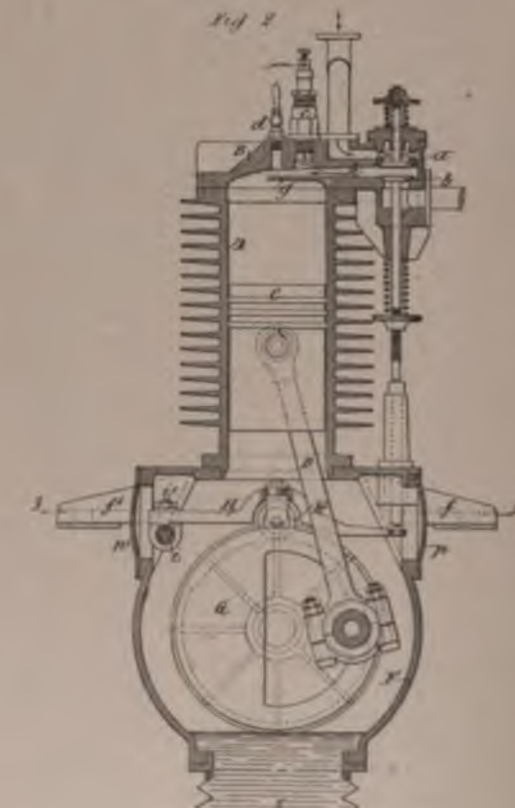
mission valve, a, an exhaust valve, b, an ignition device, c, and a starting cock, d.

C and C′ are the pistons, connected by connecting rods D and D′ to the single crank of the driving shaft E, which is carried by bearings e and e′, fixed upon the lid of a gear case or envelope, F, upon which are fixed the cylinders A and A′ and which is provided with lugs f f′, for mounting the motor. At the upper portion of each cylinder is provided a partition membrane, g, compelling the fresh gas admitted by the valve a to force before it when suction takes place the burned gases which may be within the cylinder and not permitting it to mingle with them in the admission pipe h. It follows that the ignition of the gas takes place under the best possible conditions.

The main feature of the present invention consists in the construction adopted for operating the exhaust valves. This operating mechanism consists of a cam, G, which is rigidly attached to the crank of the driving shaft E between the two connecting rods D and D′, and having as center of rotation the axis of the said shaft itself. This cam provides two paths intersecting at a single point, x. Its construction presents no peculiarity and is well known. Above this cam is arranged a lever, H, provided with a rotating roller, h², engaged in its groove in the form of the figure 8. This lever is jointed upon the casing F by means of two perpendicular pivots i i′, which enable it to follow, by means of its roller h², the various reliefs of the cam and the 8-shaped configuration. It follows from this that there is imparted to the lever both a vertical and a horizontal displacement at the same time. This horizontal movement transports the free extremity of the lever H from 1 to 2, and it is in each of these positions that it is submitted to vertical movement. Upon the right hand of these points 1 and 2 are the rods j and j′ of the exhaust valves, which, as is apparent, are alternately submitted to the action of the cam G, which serves to lift them every second revolution in order to effect the exhaust. It will be noticed that while one of the cylinders is in the exhaust stage the other cylinder is in the compression stage and that the two pistons, although receiving contrary impulses, act in unison and produce a uniform driving action. It will also be noticed that the casing F is provided with two small cover plates p p′, which when removed enable the lever H to be inspected and, if necessary, dismounted.

The casing F is combined with a bellows S, formed of leather after the manner of a forge bellows and of a suitably undulated metal sheet. This bellows is acted upon by the pressures and reduction of pressure which take place within the casing—that is to say, it becomes inflated or deflated in accordance with the direction of the stroke of the pistons. In these conditions the oil with which the casing F is partially filled is isolated from the alternate compressions of the air contained within the said casing and has no tendency to escape into the atmosphere, as is ordinarily the case. Leakage of oil is thus obviated, whereby a considerable economy is effected in the cost of running the motor.

Fig. 2



It is obvious that my invention applies equally well to one-cylinder motors and that the arrangement will be the same as regards the 8-shaped cam, because it is only necessary to raise the valve every second revolution in any case. In this case the lever is raised in space at one of the two revolutions.

Two claims. Application filed Jan. 31, 1899.

No. 12,694—Oct. 21, 1899—Folding Canopy for Motor Carriages.—The Motor Mfg. Co., Ltd., Holborn Viaduct, London, and Geo. Iden, of Motor Mills, Coventry, England.

This invention relates to motor wagonettes, char-a-bancs or other carriages and has for its object to provide a folding canopy and sides therefor.

For the sake of example this invention will be described as applied to a wagonette.

The sides are formed separately from each other and from the back end; all three of these parts advantageously being formed of wood, with the lower part of each hinged to the upper part, and each or either of such parts formed like a wooden sash or window frame to receive therein a sheet or panel of celluloid or other suitable material advantageously transparent or translucent.

The back end may be similarly formed advantageously in the form of an arch (and provided with a door or curtain, etc., if desired), so as to afford entrance and exit.

The upper part of each side at its forward end is extended forwardly so as to carry (or extend under) the canopy over the driver's seat and front part of the vehicle.

The top is formed of a light frame or framework, over which is stretched or mounted any suitable material such as a waterproofed fabric or other waterproof material.

The whole of this superstructure of canopy roof and sides is supported on the carriage by means of suitable stanchions or posts, which at their lower end fit into sockets (fixed to the body of the carriage) and adapted to receive said stanchions—the latter being advantageously secured by nuts screwed on to the ends of same, the sides and back end being secured to said stanchions by any suitable fastening devices.

Two claims. Application filed June 17, 1899.

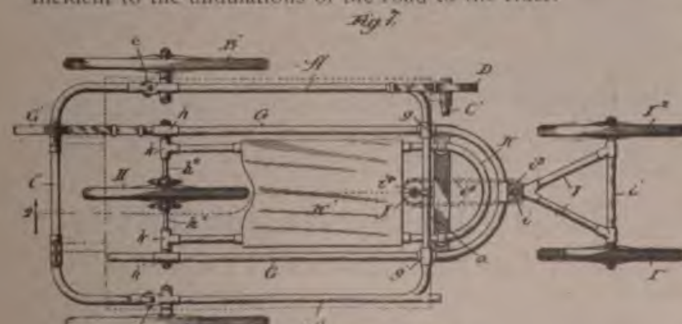
BRITISH PATENTS.

No. 15,722—Oct. 7, 1899—Improvements in Motor Road Vehicles.—Bohn Chapin Hicks, Chicago, Ill., U. S. A.

Fig. 1 is a plan of the running gear of a vehicle, and Fig. 2 a vertical section taken on line 2 of Fig. 1.

It is well known that it is highly desirable to have a running gear of a vehicle—especially a motor vehicle—constructed so that it will take the running on elevations and depressions of the road in a way that will minimize the transmission of shocks incident to the undulations of the road to the rider.

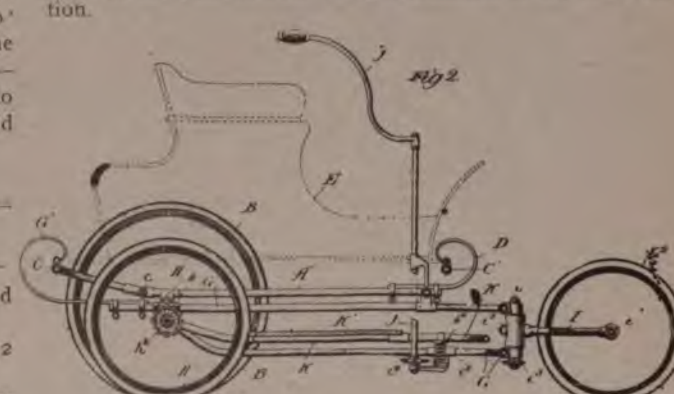
Fig 1



In constructing a vehicle in accordance with my improvements, I make a main frame having outside bars A and A^1 connected together at a base or cross bar, a, so that their frame when disassociated from the other parts is substantially U-shaped. Rotatably mounted in this frame portion are the rear supporting wheels B and B^1, which may be of any desired construction, although I prefer to use the ordinary pneumatic tired bicycle wheel. In order to support the wagon body on this frame, a U-shaped connecting supporting bar, C, is provided and pivotally secured to the rear portions of the outside bar at c. I also provide a second connecting, supporting bar C^1, which is supported on the side bars by means of the curled springs D. The wagon body E is supported at the front on this front connecting, supporting bar C^1, and at the rear portion on the rear U-shaped connecting supporting bar C.

A supplementary frame portion, G, is provided, which is also substantially U-shaped when disassociated from other parts, and which is pivotally connected to the cross bar a of the main frame at g and g^1. This supplementary frame portion is flexibly connected at its rear portions with the U-shaped connecting supporting bar C by means of the curled springs G^1, and is provided with a single driving wheel, H, rotatably mounted in the bearings h and h^1 by means of the axle h^2. It will thus be seen that when the main supporting wheels are elevated and raise their frame portion, the elevation and consequent depressions are not transmitted to the driving wheel H. The reverse is also true when considering the relation of the driving wheel to the main frame, for the reason that the supplementary frame swings on its pivots and prevents the positive effect of one portion from being transmitted to the other portion.

Fig 2



To support the running gear at the front end and provide steering mechanism, a V-shaped extension, I, is provided and pivotally connected to the supporting frame in a vertical steering pin or stud, i, so that as the steering wheels I^1 and I^2—which are rotatably mounted on the front member i^1 of the V-shaped extension—are moved laterally, sufficient room is provided for them to make the proper turn and obtain the proper direction for the vehicle without contracting any other member of the running gear.

It is also desirable that these wheels be permitted to take undulations which may exist in different portions of the road. In order to accomplish this result, the steering stud i is bored so as to furnish a bearing for the extension i^2 of the V-shaped extension, and thus permit the steering wheel frame to have a rotatable motion in a vertical plane, as well as a steering motion in a horizontal plane. The steering stud is provided with a sprocket, i^3, at its lower end, engaging a sprocket, i^4, on the

lower end of the steering rod J by means of the sprocket chain i^2. The upper part of the steering rod is provided with a handle, j, directly over the seat of the wagon body.

In order to furnish a yielding platform upon which to mount any desired motor or engine which may be used for the purpose of generating power to drive the vehicle, an auxiliary supporting frame portion, K, is provided, which is also substantially U-shaped when disassociated from the other parts, and which is pivotally mounted on the axle h^2 at the bearing points k and k^1. This auxiliary supporting frame is yieldingly held on the supplementary frame by means of the helical springs k^2, as shown in Fig. 2, and is provided with a platform, K^1, upon which the motor may be mounted. From the above description it will be seen that the shocks incident to the running of the vehicle are minimized before they are transmitted to the motor platform.

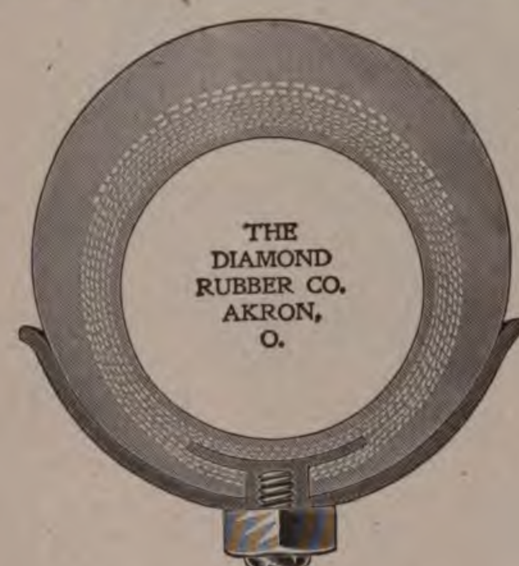
Seven claims.

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

DIAMOND TIRES.

THEY ALL CLAIM TO KNOW HOW, BUT DO THEY?



WE DO, AND IT'S BEEN PROVED.

MADE IN AKRON, OHIO. BY **THE DIAMOND RUBBER CO.**

YOU WILL BE HELD RESPONSIBLE....

WHEN the year 1900 has been ushered in and the approach of spring strongly argues in favor of automobile joys; when your expectations that a good motor carriage can be purchased for less than present quotation are not realized—then you will place your order and be greatly disappointed because immediate delivery is impossible. Your name will have to be placed upon the "waiting list." The delay to you will be exasperating.

Your order now, for spring delivery, will mean the benefit of our best service at that time.

Luxury of Locomotion. Strength, Durability, Speed and Beauty.

The Winton is an all season carriage. Cold weather does not affect its successful operation. . . . .

Absolutely Safe, Swift and Sure. The Winton is for All Seasons.

Records for durability and speed still stand to our credit. . . . .

PRICE, $1,000. NO AGENTS.

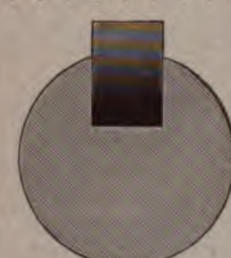
With the Winton Hydro-Carbon Motor there is **Absolutely No Danger from Fire or Explosion.**
Argument for economical operation always to the front. One hundred miles—three gallons of gasoline (or naphtha).

WRITE FOR CATALOG.

THE WINTON MOTOR CARRIAGE CO., CLEVELAND, OHIO, U. S. A.

THE WOODRUFF PATENT SYSTEM OF KEYING

Is used by The Largest Automobile Works in this Country. For Keying Gears, Sprockets, Cranks, etc., to Shafts. . . . .



WE CARRY 41 SIZES OF KEYS AND CUTTERS IN STOCK.

SEND FOR CIRCULAR.

THE WHITNEY MANUFACTURING CO.,
HARTFORD, CONN., U. S. A.

EXPLOSIVE MOTOR NUMBER.

TO be issued January 17th. Dealing thoroughly with gasoline, kerosene, alcohol, etc., vehicle motors and motor vehicles. Leading articles by **R. I. Clegg, E. J. Stoddard, P. M. Heldt, Herbert L. Towle, P. L. Tygard** and others. **Eighty pages,** many illustrations. **Ten cents,** stamps or coin. **Subscription:** Domestic, $2.00; foreign, $3.00 a year in advance. ☞ Send for our **STEAM BOILER NUMBER OF DECEMBER 6, 1899,** 10 cents.

THE HORSELESS AGE, 150 Nassau Street, N. Y. WEEKLY. ESTABLISHED 1895.

STEAM . BOILER . NUMBER, DECEMBER 6th.

TEN SPECIAL ARTICLES

....BY....

Leading Engineers and Inventors on the Steam Boiler as related to Vehicles, treating the subject thoroughly and showing how steam can be most successfully applied.

10 CENTS, STAMPS OR COIN

SYMPOSIUM OF STEAM VEHICLE ENGINEERING.

THE HORSELESS AGE,
150 NASSAU STREET,
NEW YORK.

Fifth National Exhibition

OF

CYCLES,

AUTOMOBILES

AND

ACCESSORIES

MADISON SQUARE GARDEN

NEW YORK CITY,

January 20th to 27th, 1900.

Applications for space can be made to

FRANK W. SANGER,
PRESIDENT, NATIONAL CYCLE EXHIBITION CO.,
MADISON SQUARE GARDEN,
NEW YORK CITY, N. Y.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. V. NEW YORK, JANUARY 3, 1900. No. 14.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

1900.

The new century opens most auspiciously for the motor vehicle industry in the United States. After five years of neglect the industrial infant is beginning to receive the attention its merit deserves. The manufacture of motor vehicles and accessories is now generally recognized as the coming industry for the next two decades, and the enterprising of all classes are turning to it as a new El Dorado where fortunes and commercial honors in plenty may be won.

The promoters who were endeavoring to deceive the public have been exposed and discomfited. Legitimate capital is now ready to join hands with the engineers who during the weary years of waiting have been educating themselves to take part in the practical development of this new mechanical field. The demand, particularly for all kinds of commercial vehicles, is virtually unlimited. For all who with honest intentions and good abilities join in the work of superseding that twentieth century anachronism, the horse, by mechanical power, there is apparently ample room. The prospect seems indeed rosy with hope.

But though the opportunities are great and the future bright, there is at this early stage urgent need of prudence and conservatism on the part of those who, having participated in the struggles of pioneering, would also share in the rewards of better days. Many mistakes have already been made in consequence of undue haste and excessive enthusiasm. Let faddish fancies be dismissed and enthusiasm tempered by discretion. Close study of the peculiar mechanical and commercial conditions of the new industry is absolutely essential to success. It will not do to blindly imitate methods which in other lines and in other years achieved success. In all great industries as in all great men there is individuality. Let this individuality be found and developed, and a wise conservatism displayed in approaching the untried problems that confront us, and the New Year should be a happy year for the new industry. Let its motto be that of the Latin poet—"Hasten slowly."

Electric Vehicle Number Later.

The editor of The Horseless Age is frequently asked why he does not publish a special number on electric vehicles, bringing out the good features of this system of locomotion, so that a more thorough comparison may be made with other powers in the field.

The advantages of the electric vehicle have frequently been mentioned in The Horseless Age, but its disadvantages have also been candidly stated. These disadvantages so outweigh the advantages that those who are ignorant of physics and mechanics or who are under the promoter's spell no doubt regard our views as prejudiced. Yet these views can be veri-

fied in any chemical laboratory, and no competent consulting engineer will deny them.

There was, moreover, one supreme and urgent reason that justified us in rudely scattering the halo with which the electric vehicle had been surrounded and showing it in its stern reality—the heavy, costly, troublesome and inefficient thing it is. Designing men, emboldened by the prevailing speculative boom and conjuring with the magic word "electric," had concocted a gigantic scheme of plunder to loot the motor vehicle industry and then leave it to its fate. Had this scheme been fully carried out the industry would have been crippled for several years to come. Victims of their stock-jobbing operations would have been counted by thousands, the industry would have been characterized as a fraud and the electric vehicle itself would have received a setback from which it could not have recovered in years. Happily, this iniquitous scheme has been foiled and correct ideas are taking root in regard to the electric vehicle and the part it can profitably play in the new industry.

When the Lead Cab Trust is entirely through promoting and the electric vehicle stands on an honest basis The Horseless Age will take it up again from an engineering point of view and endeavor to repair the damage promoters have done it, defining more carefully the limited field it is possible for it to fill in the new locomotion.

Park Permits for Gasoline Carriages Too.

President Clausen is relenting again. Up to the present time he has refused admission to all except electric vehicles. Gasoline vehicles he believed too noisy and steam vehicles too free in exhaust to be permitted to enter the Park drives. But the timid Park guardian has found by experience that the gasoline vehicle is not half so bad as it has been painted, and has granted one permit for a vehicle of this class. Others are sure to follow, now that the deadlock has been broken.

Courage, Mr. Clausen, you are doing bravely. We may soon expect to see you guiding your own automobile in the exclusive domain which you have rather too jealously guarded, lover of horseflesh though you are.

Speed Laws.

Advocates of the motor vehicle claim with justice that it is more easily controlled than the horse and can therefore be safely allowed higher rates of speed than the horse vehicle in public streets. In proof of this it is only necessary to refer to the sensitiveness of the steering of a motor vehicle as compared with the slow and awkward reining of a horse, and to the abruptness with which a motor vehicle equipped with proper brakes can be stopped. But notwithstanding the marked superiority of the motor in control, it must be remembered that the streets at present are filled with horses much less easily controlled and that speeds which at some future time may be perfectly legitimate cannot now be permitted with safety. As horse vehicles decrease and the public become more accustomed to the motor the limit of speed will be gradually increased, whatever the legal provisions may be. Law always lags behind progress any way.

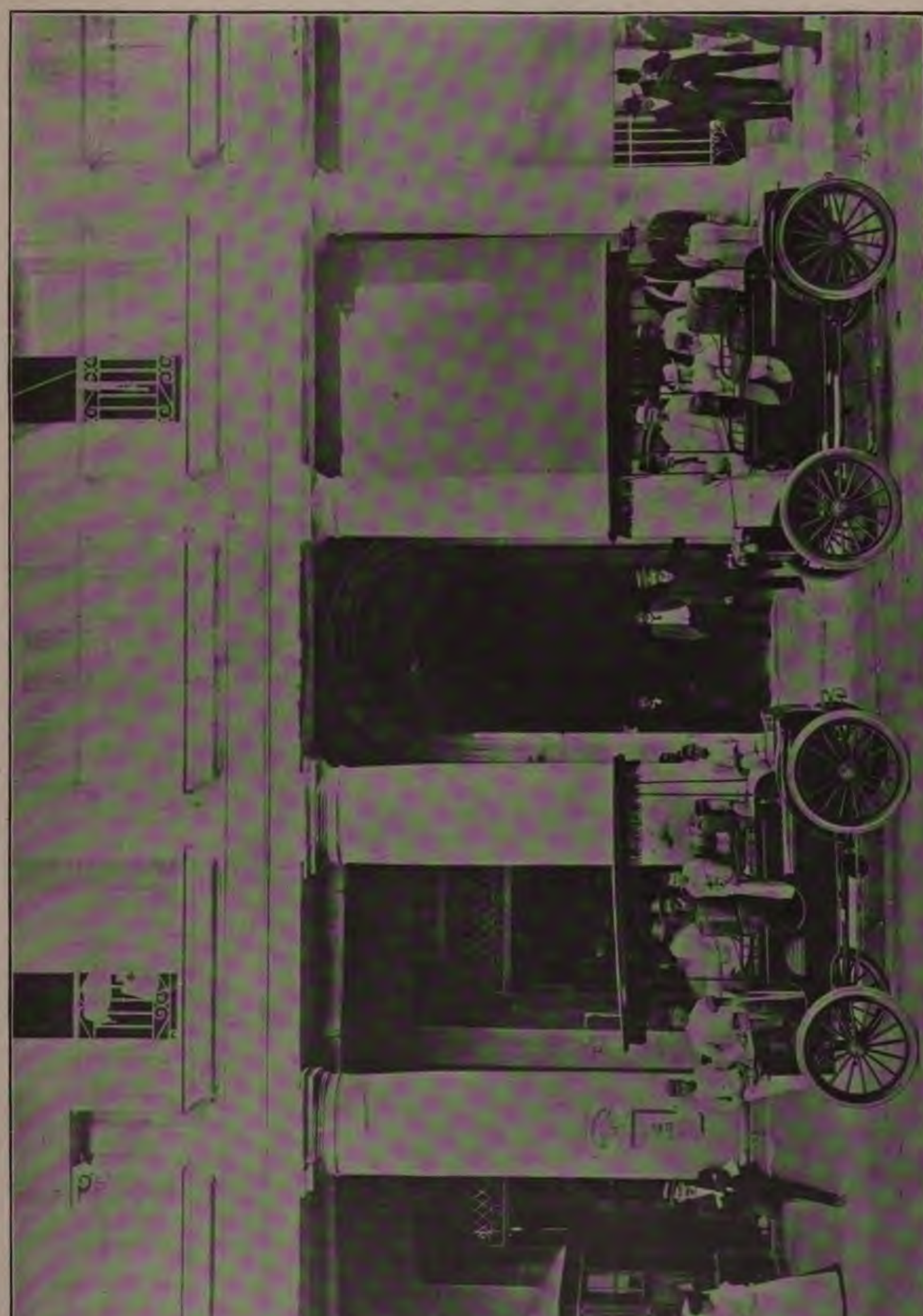
Explosive Motor Number.

Our Steam Boiler Number of Dec. 6 has been very well received, and we believe we have disseminated through its agency a great deal of sound information about the steam vehicle. Our Explosive Motor Number of Jan. 17 will be equally valuable in its exposition of the gasoline and other vehicles propelled by explosive motors.

Our advertisers get results because our readers get information. We appeal to the intelligent, sincere and persevering class who will constitute the future motor vehicle industry.

Explosive Motor Inventors.

Inventors of improved devices in explosive vehicle motors and vehicles are requested to communicate with the editor without delay, as we wish to incorporate the latest improvements in our Explosive Motor Number of Jan. 17.



OFFICE OF THE HAVANA AUTOMOBILE TRANSFER CO., 87 PRADO ST., HAVANA, CUBA.

LONDON NOTES.

London, Dec. 17.

REPORT OF THE DAIMLER MOTOR CO.

The report of the Daimler Motor Co., Ltd., Coventry, has made its appearance this week. The balance sheet and accounts, which are for the fifteen months ending Sept. 30, 1899, show a net profit of £1,045. Toward the close of last year, owing to slackness of orders, and for financial reasons, a large proportion of the skilled workmen were discharged and the factory was carried on unprofitably for many months. During the present year energetic measures have been taken to push the business, and the staff of men has been increased as rapidly as possible. The directors have booked large orders, and the full complement of men has been engaged. The factory is now working overtime at its full capacity on profitable orders, and will be so doing through the winter. The company's financial position is on a strong basis. The debenture interest, including all arrears, has been paid, all engagements are promptly met, and there is a balance of £11,226 on hand.

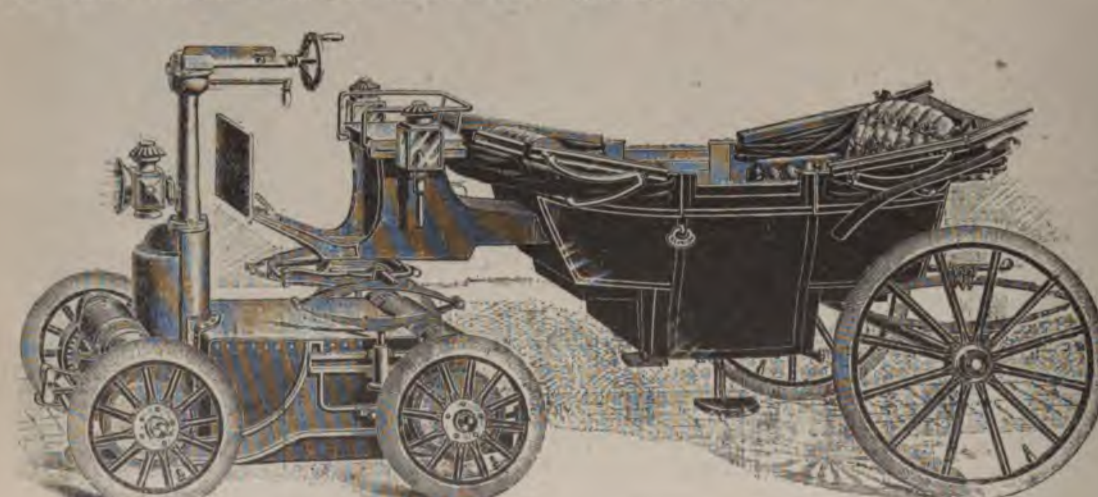
THE HEILMANN ELECTRIC AVANT TRAIN.

M. Heilmann, of Paris, the designer and builder of the Heilmann electric locomotive used by the Western Ry. Co., of France, has lately been devoting attention to the subject of electric automobiles and has produced the avant train, which can be attached to any existing vehicle by simply removing the front wheels and axle, as shown in accompanying illustration.

M. Heilmann, in the course of an interview on the subject of his latest production, said: "My bogie can be adapted to any kind of a vehicle and replaces horses altogether. Every one does not desire to travel in an automobile at the rate of 60 kilometers an hour, as in a racing machine. A speed of 20 to 25 kilometers an hour is quite sufficient for the ordinary public, and this is very much better than what could be attained with a horse. While with a horse one can travel, say, 40 kilometers a day, with one of my bogie machines twice that distance can be covered. This bogie is intended for such practical uses as the drawing of cabs, landaus, victorias and delivery carts or wagons. In other words, it is meant to replace utility horses. Up to the present time the electric bogie is only in use, but in a short time the same invention adapted to petroleum will be put on the market, because of the difficulty, at the present time, of recharging the electric machine. The electric bogie can cover a distance of 60 kilometers without recharging, and its maximum speed is 25 kilometers an hour. A 10 h. p. electric bogie weighs 1,000 kilogrammes. The driver has complete control over the machine. The right hand is practically free, and is only required when changing the speed. His left hand guides the vehicle, and the foot controls the brake."

The example set by French builders of automobiles in the matter of special high-powered carriages for racing purposes is being followed in Germany. I have already sent you particulars of the Benz racing carriage, while now I am able to send you an illustration of the special racing carriage just completed by the Daimler Motoren Gesellschaft at the works at Cannstatt, Wurtemburg. The carriage is fitted with a four-cylinder Daimler motor, capable of developing no less than 23 h.p. Four speeds and reverse motions are provided, the power from the intermediary shaft to the rear road axle being transmitted by chain gearing. The variable speed gear is so arranged that the friction clutch is automatically thrown out before a change is made in the gear. The ignition is on the magneto-electrical system, and the company's own type. Special attention has been devoted to the water cooling arrangements, while no less than six brakes are available—two on the rear axle, two on the extension of the motor shaft, and two on the intermediary shaft. The carriage, which is fitted with stout pneumatic tires and inclined wheel steering, is stated to be capable of attaining a speed of no less than 50 miles per hour.

The Madelvic Motor Carriage Co., Ltd., Granton, N. B., is to be wound up under the supervision of the Court. The company was formed in January, 1898, with a nominal capital of £25,000, and a manufactory was erected at Granton at a cost of £33,000. None of the additional capital was subscribed for, and at an extraordinary meeting of the company held last week it was unanimously resolved to wind up the business voluntarily in consequence of the liabilities. Apparently the company made the mistake of starting off in a big way—for the factory at Granton is a large one—ere it was ready with a practical vehicle.



THE HEILMANN AVANT TRAIN.

The Scamman Vehicle Boiler.

C. F. Scamman, of Deering, Me., furnishes a design for a water tube boiler which he believes has the desired steaming capacity.

The coils are 12 x 18 in. outside and the outside of casing will be 16 x 23 in. It contains 454 ft. of ½-in. 18-gauge copper tubes.

In case of accident any one or two of the coils can be stopped off without disturbing the casing by plugging the tube through the water ring and steaming from the outside.

Mr. Scamman is building a pair of engines for this boiler, which will be 22 x 11½ x 15½ in. in size, and will be cross compound reversible, with cylinders 2¾ x 5 and 3½ in. stroke. No eccentrics or links will be used.

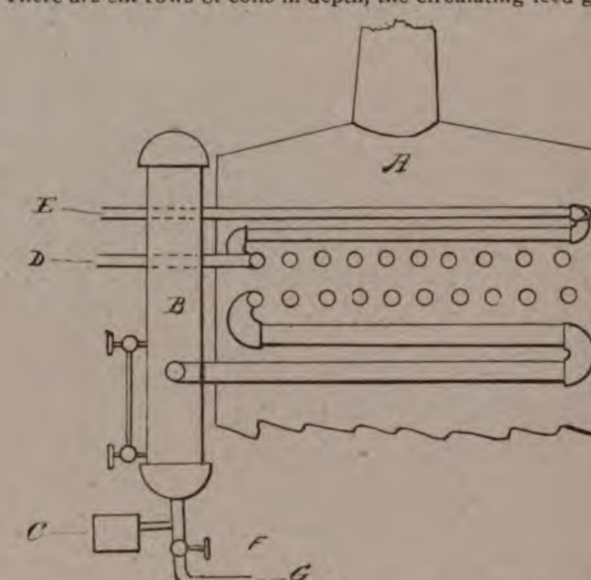
The Herreshoff Coil Boiler.

By R. I. Clegg.

In the Steam Boiler Number of The Horseless Age I had occasion to refer to the work of the Herreshoff Mfg. Co., of Bristol, R. I., and I pointed out that a detail drawing of one of their boilers could be found in the treatise on "Steam Boilers" by Prof. R. H. Thurston, of Sibley College.

This particular boiler was of conical shape, and the Herreshoffs did not limit their efforts to this form by any means, and herewith I show a rough sketch of the same type of steam generator in a rectangular arrangement. A is the boiler casing and B the separator; C is the circulating pump; D is connected to the circulating pump at bottom of separator; E is the feed water inlet to boiler; F is the surface blow-off valve and G leads to the water tank.

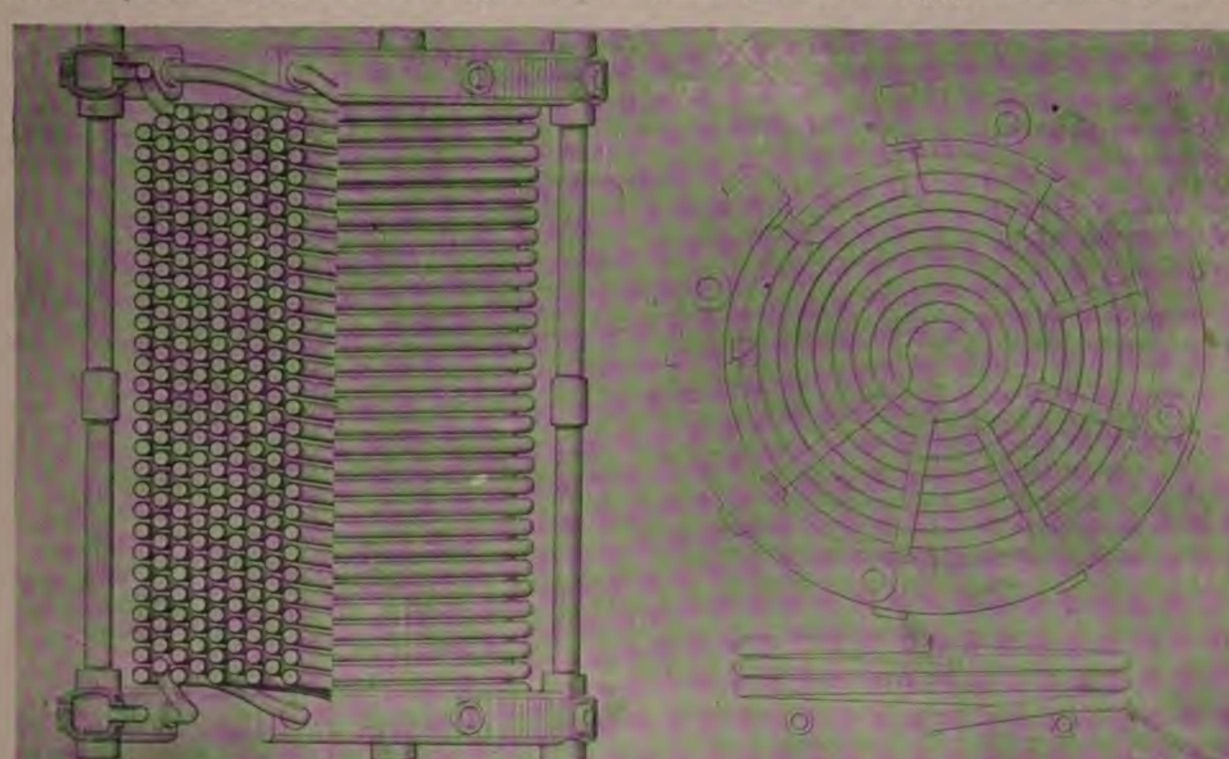
The tubes are arranged in tiers at right angles as shown. There are six rows of coils in depth, the circulating feed going



in at the third row from the top, though whether there was any special reason for the selection of this particular coil I have not been able to ascertain.

The two upper coils are ¾-in. pipe, the next two rows are 1-in., and the others 1¼-in. pipe.

The separator extends below the boiler so that the water column will show the supply without flooding the bottom



COIL VEHICLE BOILER, C. F. SCAMMAN, DEERING, ME.

tubes. At the same time at the top of separator is taken the steam for the engine.

If there should be any sudden rush of water through the tubes and the water increase too rapidly in the glass, the surface blow-off at F is opened and the surplus sent back to the supply tank. This serves for special needs, but, as in other boilers, general conditions are met by regulating the supply through E.

The separator is 3½ or 4 in. in diameter.

A boiler of this kind (in general known by the name of a box boiler as distinguished from the beehive generator of the same make) was capable of remarkable results in expert hands, and very many have been put into the small Government launches.

To an engineer accustomed to the sight of a steam gauge with a hand so stationary as to seem nailed to the dial, one of these boilers is a revelation in boiler practice, and the rapidly moving gauge when a launch was pushed off from the wharf and speedily put under way was anything but reassuring to the tyro. The excellence of the materials employed produced good wearing qualities, and I have been much surprised at the accounts received from the Government inspectors who have had these generators under supervision.

It may be that the skill required to operate one of these boilers would be beyond the class who will be called upon to manage steam vehicles for heavy transportation, but I do not doubt that our designers will be equal to the occasion should there be a desire to adopt a generator of this type and supply such automatic controlling devices as to meet the needs of the case.

MINOR MENTION.

A. H. Overman has returned from Europe, but will visit Paris again soon.

D. L. Davis, superintendent of the Salem (O.) electric railroad, is constructing a motor vehicle.

The Oakman Motor Vehicle Co., Greenfield, Mass., will exhibit at Madison Square Garden this month.

C. F. Smisor, Webster City, Ia., is endeavoring to organize a company to manufacture motor vehicles at Des Moines, Ia.

A parade of automobiles is set for New Year's day at Cleveland, O. About 25 vehicles are owned in the city—nine electric, five steam and eleven gasoline vehicles.

The Committee on Sports of the Automobile Club of France has set June 15, 1900, as the day for the International race for the Bennett Cup. The route has not been chosen.

A new Delaware corporation is the Automobile Storage & Repair Co., capital stock $50,000, composed of New York parties, who will open an emporium at 57 W. 66th St., N. Y., at once.

The General Power Co., 100 William St. New York, makers of the Secor Oil Motor, are building a motor vehicle propelled by their motor, which they hope to have completed before spring.

The Eureka Automobile Transportation Co., of San Francisco, Cal., has been incorporated with $500,000 capital. The incorporators are C. L. Fair, S. Bennett, G. A. Knight, C. J. Higgerty and W. H. Kent, of San Francisco.

H. A. Wagner has resigned from the superintendency of the Missouri-Edison Electric Co., St. Louis, Mo., and will devote his attention to the Mississippi Valley Automobile Transportation Co., which expects to be ready to commence business in February.

The Duryea Motor Co., the concern that recently bought out the business of the Duryea Mfg. Co., Peoria, Ill., has opened offices at 149 Broadway, New York. Charles E. Duryea is now located in Providence, where the vehicles will be manufactured for the Duryea Motor Co. by the International Power Co.

The American Electric Vehicle Co. has been incorporated in New Jersey with $5,000,000 capital to manufacture all kinds of motor vehicles. The incorporators are Myles Tierney, George B. Hurst, New York; George T. Lister, Jersey City, and Henry Young, Jr., Newark. Only $1,000 is paid up. There are 4,000 shares of common and 10,000 shares of preferred stock.

The Bethlehem Steel Co., whose advertisement appears in this issue, is distributing a handsome calendar mounted on a card about 12 x 18 in., with an engraving at the head showing one of their heavy hydraulic forging presses working up a hollow shaft from an ingot of fluid compressed steel. On the twelve monthly sheets appear photogravures of representative forgings produced at the Bethlehem plant, the whole being very effective. The calendars have been sent to the company's correspondents and customers, but we are informed that an application to one of their offices will secure a copy for those who have not already received one.

COMMUNICATIONS.

Details of the De Dion Motor.

Philadelphia, Pa., Dec. 23.

Editor Horseless Age:

If you would publish a scale drawing of the De Dion motor, together with carbureter and ignition apparatus, I think it would be highly appreciated by all your readers, especially by the practical workers and experimenters.

It would be of great advantage to those (like myself) who are unable to purchase a motor for dissection to see exactly what proportions and arrangement have been adopted by builders who have had more practical experience than any others in the manufacture of small motors. P. H. B.

We shall devote some attention to the De Dion motor and shall also give dimensions of a small motor that will not, we trust, infringe upon the De Dion patents.

Dr. Duval's Hydraulic Steering Device.

Lynn, Mass., Dec. 26.

Editor Horseless Age:

In reply to a communication from Dr. Duval in The Horseless Age of Dec. 20, entitled "Hydraulic Steering Device," will say that the General Electric Co. have used a similar device since July, 1897, on carriages varying in weight from 3,000 to 1,000 lbs. It embodies in a general way the same idea as shown by the doctor, but in its preferred form differs therefrom in that the steering handle has not to be moved in a different direction from that of steering for the mere unlocking of the valves, but opens the latter by the moving of the steering handle in whatever direction the carriage is being steered. By this arrangement the driver can make no mistake, even if rattled, the whole function being unconscious and always right. It has the further advantage that if during the operation of steering an obstruction should be met this very action would close the valves and relieve the operator, whereas in the arrangement shown just at that moment the check may fail him unless the operator has presence of mind enough to close the valves.

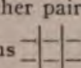
We shall shortly publish a full description of this device, which has proven itself not only to be a safeguard against the many accidents one reads about, in which the operator of automobiles loses control of the direction, but is also a great relief from the physical strains experienced while driving over rough country roads, as all strains are taken up by the frame of the carriage. Reference to this device has been made at various times in The Horseless Age. Very truly yours,

HERMANN LEMP.

Relighting Extinguished Burners.

Lenox, Mass., Dec. 15.

Editor Horseless Age:

I have been reading over the article on the Locomobile by R. I. Clegg in your issue of Dec. 6. He speaks of the danger, when the boiler pressure cuts off the fuel supply, of the small flame being extinguished. If, say, four platinum wires were strung over the fire box, two of them running parallel to each other and making one pair, the other pair also parallel but at a right angle, to the other pair, thus  would they, in your opinion, retain their heat long enough to fire the gasoline before the danger point was reached—that is, before condensation takes place? I understand our gas buoys are relit in this way when put out by gusts of wind or waves. Would you also please tell me what a pilot light is? Is it an independent spray of gasoline, an electric spark, or what?

WM. H. BRADFORD.

1. We do not remember any other objection to the platinum wires than the matter of expense and do not have sufficient data to determine whether this item would be fully met by the advantages of this particular method of relighting.

2. Pilot light is purely a conventional term applied to an independent source of ignition; the latter may be a kerosene torch, as in some of the small crude oil injectors, a mass of fire brick, as in the House burner, a gas jet or similar relighting device when the main burner is temporarily extinguished.

R. I. C.

Burner Data Wanted.

Montreal, Dec. 19.

Editor Horseless Age:

Will you kindly give me the following information through your columns: What are the working dimensions of the burner Fig. 3, page 36, of the Steam Boiler Number? State particularly the outside and inside diameters of a, giving the thickness of the walls; also the sizes of c, d and b and particulars of burner part for say 40 h.p. By so doing you will greatly oblige

W.

We do not have dimensions of the burner and would refer you to the makers—the Liquid Fuel Engineering Co., Bridgeport, Conn.

R. I. C.

An Algebraic Formula Reformed.

Champaign, Ill., Dec. 23.

Editor Horseless Age:

I have read with interest the articles in your valuable paper for some months and consider the Steam Boiler Number a work in which you have cause to congratulate yourself. I look forward to the Explosive Motor Number with still more anticipation, as I am particularly interested in that phase of the subject. I think it is the most desirable motor for this service.

In reading your number of Nov. 22, '99, I came across the answer of E. J. Stoddard to the inquiry of J. F. B., and, while I do not wish to criticise it unduly, I will say that I could not understand his explanations. He says: "If we assume the approximate formula $PV = C$, then the relation

$$\sqrt[3]{\frac{V}{V_1}} = \sqrt[4]{\frac{P_1}{P}}$$

holds." In the first place the formula $PV = C$ cannot be considered even approximate for the expansion or compression curves. Further, it is readily seen that the equation $PV = C$ or $PV = P, U$, is not equivalent to

$$\sqrt[3]{\frac{V}{V_1}} = \sqrt[4]{\frac{P_1}{P}}$$

which is contrary to simple algebra.

Respectfully yours,

E. C. OLIVER,

Instructor in Engineering Laboratory, University of Illinois.

OUR FOREIGN EXCHANGES.

Traffic Regulation and the Speed of Motor Vehicles on Highways.*

*A paper read before the Automobile Club of Great Britain, 4, Whitehall Court, London, by R. E. B. Crompton, formerly Supt. Govt. Steam Trains in India, Past Pres. Inst. Elect. Eng., M. Inst., C. E. Mech. Eng. In the chair Sir Richard Webster, Bart. G.C.M.G., Q.C., M.P.

This subject is of paramount interest to automobilists, to the general public and to those responsible for the regulation of traffic in the streets of our towns and on our country roads.

The great congestion of London street traffic has formed the subject of two papers read by Sir John Wolfe Barry, K.C.B., before the Society of Arts, the first during last session and the second of them on Nov. 17 last. To use Sir John's words, "We have to face the absolute necessity of providing our working classes with thoroughfares by which they can reach their homes from their place of employment," and he showed that the great development of traveling from all parts of the kingdom threw ever increasing streams of traffic on our overcrowded streets.

In addressing this audience I naturally fix on the points of greatest interest to automobilists, in which I include the vast and increasing army of cyclists. I include the great speed question, as it is one of the most important factors to be dealt with by regulation, both as regards street traffic and that on country roads. I hope to be able to use arguments which will be equally appreciated by you who are automobilists and by the public who are not, but who desire improvement in the existing state of things. I hope to show you how the admitted congestion of street traffic can be to some extent mitigated by well considered regulation of horse drawn as well as automobile traffic, and that we may hope for immediate improvement even if the existing regulations are strictly enforced on every one who uses the streets, whether they be drivers of vehicles drawn by horses, automobilists, cyclists, or foot passengers. I also hope to show you that we automobilists have reasonable rights, and that the new conditions created by us and by cycling will necessitate certain new regulations being enforced on those who are responsible for the maintenance of our highways.

I am afraid that an impression has got abroad that the great spread of cycling and the introduction of automobilism have been attended by increased congestion of street traffic and increased danger to other users of our roads, and that this idea is present in the minds of a considerable number of men in authority is proved by the number of magisterial decisions which give any fair minded person the impression that those responsible for these decisions consider that automobilism and cycling are both of them evils rather than benefits, and are therefore to be stamped out at all hazards by restrictive regulations and legislation. Of course, my present audience knows that this impression is erroneous; it is due probably to the natural conservatism of horse owners and horse lovers, who are also magistrates, and who have the idea that any increase of automobilism is antagonistic to the horse. It is also probably due to the fact that automobilism has caused country roads to be now so greatly used that country folk who were accustomed to wander over them at their own sweet will, undisturbed by the automobilist's horn or the cyclist's bell, resent any interference with their past license.

Addressing myself first to the more important question of the congestion of street traffic, many people appear to think that every additional motor car or cycle put on the streets will be an additional cause of block or congestion of traffic, and perhaps will also have a tendency to increase the number of street accidents; but it can be easily shown that the reverse is the case, chiefly because automobiles occupy less space than horse drawn vehicles carrying the same load, and because cyclists can, to a great extent, thread in and out through narrow lanes between lines of traffic, and thus utilize space which would otherwise be wasted.

Street traffic is conducted in conformity with the rule of the road. Put briefly, the rule of the road is to keep to the left or near side; when overtaking to keep as close to the off side of the overtaken vehicle as possible. The rule of the road is mentioned in clause 78 of an act of Parliament, 5 and 6 of William IV., commonly called the Highways Act. There are other rules of the road which are not mentioned in this act, but which are of great importance. One is that the traffic on a minor road joining or crossing a main road must always give way to the traffic on the main road. In many of the crossings in large cities the roads are of equal importance; hence blocks are likely to occur at these points from uncertainty as to which line of traffic is to give way to the other. At these points it is customary to place police constables, whose duty is to declare from time to time which is to be the main line of traffic, and this duty is very efficiently carried out by our city and metropolitan police to the admiration of every one who visits London.

The regulation of street traffic, however, is complicated by several considerations, such as the following: Our streets are not merely used as roads for intercommunication, but also as public promenades, so that one cannot consider the question of the regulation of street traffic without taking into account the great part the promenading public play in the present congestion of traffic. Not only do foot passengers, especially ladies, greatly obstruct the footway by stopping to look in the shop windows, but carriage traffic is also purposely slowed down for the same reason. How often does one see a lady in barouche and pair occupying 20 ft. of a street direct her coachman to drive slowly in order that she may have a better view of the shop windows, and actually cross to the off side of the road for this special purpose.

The great popularity of the omnibus service is, I am informed by the District Railway authorities, due to the outside seats being so attractive as points of view for sightseeing. We must not, therefore, lose sight of the fact that the attractive shop fronts and other attractions play a great part in delaying both vehicular and pedestrian traffic.

I am about to suggest that, as the London public who use the streets are so well accustomed to obey the orders of the constables who regulate the traffic, an enormous improvement would be effected if the existing police regulations were strictly and universally enforced. It is certain that far more traffic would be passed over our streets than at present if the rule of the road was strictly adhered to by all drivers of vehicles and by cyclists. It would further improve matters if the crossing of foot passengers, fixed points for stopping omnibuses, and the loading and unloading of goods in certain main lines of thoroughfare were subject to further regulation. For some years past I, as a cycle rider, have been a close observer of London traffic, and have noticed how that drivers

of all classes habitually waste the available road surface in not obeying the rule of the road by keeping as close as possible to the near side. Instead of doing this they habitually drive down the center of the road so that other drivers who overtake them have either to pass by going on to the wrong side—that is, the near side—or they have to be forced over into the line of traffic coming in the opposite direction. It is quite common to see a line of carts, the first cart of which is driven at a considerable distance from the near curb, the next cart following a little further out, and so on until the tail of the procession is well over to the off side of the road, thus forcing any one overtaking this procession to cross to the off side and thus run the risk of an accident caused by vehicles meeting him. The "echelonning" of vehicles is not confined to drivers of carts; I regret to say that omnibus drivers, who are among the most careful of our London drivers, often do the same thing. It is convenient to call this practice road wasting, and I believe that if this road wasting were reduced to a minimum by enforcing Sir Edward Bradford's notice, which was issued in August, 1898, and by summoning the drivers until attention is paid to it, the capacity of our streets would be nearly doubled.

The theoretical disposition of traffic is in parallel lines. A road 40 ft. wide between the curbs will admit of four lines of traffic—that is, two lines in each direction—but as this would not allow of what I call overtaking space, if we attempt to calculate the maximum capacity of a 40-ft. street, we must only allow for two lines of traffic, and consider that half the street is occupied by this overtaking space.

A few words as to the passenger carrying capacity of a street of this width will be of interest. If we assume that a motor omnibus similar to those now running in Victoria St. is 16 ft. 6 in. long, and that it could be driven at an average rate of 10 miles an hour, and that it is safe to allow the omnibuses in each line to be 100 ft. apart, this would allow of nine omnibuses passing per minute, or 540 per hour, which gives a total carrying capacity of 14,080 passengers per hour in one direction. I am informed by gentlemen who are experienced in the management of tramways that the maximum carrying capacity of an electric tramway is 3,000 per hour, and I am informed that that of a suburban or metropolitan railway crowded with trains to its full extent does not exceed 10,000 per hour. This superior carrying capacity of the road when traffic has to be carried at the moderate speed of 10 miles an hour is probably due to the overtaking space I have mentioned, and it is therefore of great importance that traffic should be conducted so that overtaking space should not be wasted. Wherever a vehicle is drawn up at the curb, the traffic following it is diverted into the overtaking space, but, in order to minimize the obstruction, this line of traffic ought immediately to curve back close to the near curb, and it is by enforcing this that we must look for improvement. Drivers of all classes of vehicles must not, after overtaking a vehicle, remain in the overtaking space, in order to avoid the trouble of curving back to the near curb. At present they are in the regular habit of doing this, as it is the shortest line for them to follow, in order to overtake the next vehicle in front of them; but the result is that if a still faster vehicle, such as an automobile of a cycle, wishes to overtake them, it cannot do so without crossing to the wrong side of the road into the lines of the traffic coming in the opposite direction. It is probable that the traffic on a 60-ft. road might be conducted in such a manner as to give two continuous lines each way, and afford a third line for overtaking, and thus give double the capacity of a 40-ft. road—that is to say, that on a 60-ft. road 28,000 passengers could be carried per hour past any given point in one direction.

I believe that the enforcing of the existing regulations so that the traffic is kept in line parallel to the curb might be carried out by constables experienced in traffic work, and of these there are many in the city and metropolitan police. These constables should be mounted on cycles, or, better still, on patrolling motor cars. The expense of doing this would not be great, and the experiment would be well worth trying.

The somewhat astonishing figures that I have given you as to the carrying capacity of our roads have probably never yet been reached in practice. I believe that this is chiefly due to the extent to which our streets are blocked by cab ranks, by loitering vehicles, and by stoppages of vehicles to take up and set down passengers, and to load and unload goods. Taking the last first, the loading and unloading of coals, beer, etc., is already the subject of a notice issued May 24, 1897; it can be only carried on in certain streets within fixed hours, and the question of the extension of this regulation merits careful consideration. The space allowed for such loading and unloading ought to be minimized. The practice of allowing goods vans to be placed transversely to the line of traffic for loading and unloading ought to be stopped.

Another point on which improvement can be effected is that wherever the streets admit of more than one line of vehicles proceeding in the same direction, some attempt should be made to sort the vehicles into the two lines, according to their speeds—that is to say, the slow speed vehicles should be those nearest to the curb, and those moving at the higher speed on the next line outside of it. This is already done on London Bridge. Slow speed vehicles need overtake one another far seldomer than the fast traffic does, as they are all supposed to proceed at the walking pace of a horse, whereas the variety of speeds in the lighter vehicles is considerable, varying within limits of from 8 up to 12 miles an hour. For purposes of overtaking, a vehicle driven at an average speed of 8 miles an hour must frequently overtake at the rate of 12 miles, and this point has been very little understood by those who fixed the limit of speed of automobiles.

This brings me to the second part of my subject, namely, speed regulation of motor vehicles and cycles. It will be seen from the above figures that the amount of traffic that can be carried on the road is almost proportional to the speed—that is to say, a traffic at an average rate of 10 miles an hour will transport double the number of passengers that could be transported at 5 miles an hour, but those who are so clamorous to reduce speeds do not apparently see that halving the speed means doubling the number of vehicles required to carry a given amount of traffic, and hence doubling the overcrowding and congestion of the streets. Speed, therefore, is desirable, not only as it saves time in the transport of passengers and goods, but in that it reduces the number of vehicles in the streets. The speed of foot passengers and horse drawn vehicles has in the past been practically limited. A man can walk at 4 miles an hour, a horse from 4 to 5, and light vehicles can be drawn by a horse trotting at from 9 to 10. Hansom cabs and private carriages are frequently driven at 12 miles an hour. None of these rates are called furious driving, and rightly so, as traffic has been safely conducted at these rates for many years. The real measure of safety lies in the distance in which a driver can pull up in case of emergency, such as a person falling in the road or of a child running suddenly in front of an advancing vehicle. In all cases

it will be seen that the real measure of the danger is not in the speed of the vehicle, whether horse drawn or automobile, but in the available controlling power.

I have been at considerable pains to notice the controlling power of a skilled hansom cab driver, and I find that about 30 ft. is required in which to stop a hansom cab going at 12 miles an hour, a speed which is not considered furious driving by the police—that is to say, if the road is in ordinary winter condition, either on macadam, wood, or asphalt. On a dry road in perfect condition it is probable that this distance might be reduced to 25 ft., but a properly braked automobile driven at the same speed can be pulled up to a certainty within 15 ft., and a cycle fitted with modern brakes in 10 ft. It is therefore certain that future regulations, instead of restricting the speed, ought to prescribe the distance within which the vehicle can be pulled up in case of an emergency. It would follow on this that the police responsible for the regulation of the traffic could, if they considered that a driver is driving furiously, test it by signaling him to stop, and if he does not stop within the prescribed limit, breach of regulation could then be easily proved against the driver. In this way much of the hard swearing and ridiculous statements made by suburban and country police and others as to the speeds of automobiles and cyclists would be avoided. As the rate of speed would not be considered furious, provided it was shown that the driver was capable of pulling up within 10 ft. in a thoroughfare crowded with traffic, whereas in a country road, where he has an unobstructed view, and where there is little or no traffic, the speed limit, if any, should be that it should not cause a nuisance by noise, provided that in all cases his brake power be sufficient to enable him to pull up within 40 ft. The correct speed for automobilists and cyclists proceeding through traffic is a little higher than that of the traffic going the same way. All drivers and cyclists will agree with me that if their speed is less than that of the traffic the risk of obstructions to traffic and of accidents is far greater than if they are overtaking it. Probably, if experiments were made, it would be found that a motor car can be driven with perfect safety, and with a minimum of obstruction to other traffic, somewhat in excess of 12 miles an hour. As I have shown, reduction of speed keeps the car a longer period in the public streets; logically, it increases the obstruction caused by it, and, of course, the same holds good with cycles.

The ignorance of the public on speed questions is astonishing; few people seem to appreciate the difference between average and maximum speed. In traffic, in order to maintain an average speed of 10 miles an hour, it is probably necessary at times to pass other vehicles at 13 or 14, and on this point no one seems to be able to interpret the regulations. It appears to be probable that those responsible for the regulations when they fixed the limit in London of 12 miles an hour meant to allow automobiles to be driven at a speed slightly in excess of the ordinary horse drawn light traffic, and if my interpretation of this is correct the 12 miles an hour fixed is an average rate. It is a great pity that so much uncertainty exists on this point of the speed that is allowed. I think on the whole we may congratulate ourselves on the very reasonable view on this question taken by the metropolitan police. They appear to consider it their duty not to interfere with automobilists so long as their cars are thoroughly under control and are not driven to the danger of others, and this is the proper view to be taken of the situation. They appear to adopt the same attitude as regards cyclists, and it is a thousand pities that their view is not universally adopted by the police in all other towns and country districts.

When I talk of the controlling power that a driver has over his vehicle, I must not confine myself solely to his braking power, but I also refer to the readiness and promptitude with which he can change his direction and swing readily clear of any sudden obstable. In a horse drawn vehicle, as Mr. Montagu recently pointed out, there are two brain powers, so to speak—that is to say that in case of sudden necessity, either for stopping or to swerve, the impression has to reach the brain of the driver, and thence to be conducted by his hands to the brain of the horse, and again through the brain of the horse to his feet, which in turn govern the movement of the vehicle he is drawing. All this takes considerable time. In the case of the cycle or motor vehicle the brain impression of the driver is acted upon almost instantaneously through his hands, and hence the vehicle is diverted or stopped. The shortness of a motor vehicle as compared with a horse drawn vehicle permits of extremely rapid and hence instantaneous swerving to the right or to the left in order to avoid vehicles or foot passengers.

Up to this point I have attempted to show that if the existing Highways Act and police regulations are strictly enforced, considerable improvement in the traffic of our streets could be obtained. In order that this may be done, my suggestion is that a strong representation should be made to the Commissioner of Police that he should instruct his constables to enforce his recent notices by warning offenders, and by summoning them if they disregard the warnings. If the hours between which the heavy traffic may be allowed to stop to take up and deliver goods were made the subject of a regulation, and if loiterers and road wasters were summoned and fined, I feel sure that very considerable improvement would take place. No doubt the van drivers, wagoners, carters, covered delivery carts, and in some cases the omnibus drivers, who have hitherto considered that they may drive their vehicles as they please, cut corners, and wander over the surface of the roads as they please, would at first resent this interference with the unrestrained license which they now have, and probably additional police would be required to make these drivers respect the law. It would also be necessary to secure convictions by keeping in the streets a number of police either in uniform or plain clothes who might be mounted on motor cars or bicycles. One hundred of the constables who already do such good work at difficult crossings would, if mounted on bicycles, soon effect an astonishing alteration in London, and would enable us without spending any money on enlarging the streets to pass over them without blocks a largely increased number of vehicles.

There are, however, other means by which our streets and highways may become more efficient means of conducting traffic, but in these cases further legislation will be necessary. The first of these is the stopping of omnibuses only at fixed points, as is so usual in Continental cities. If the stopping places were placed only a few hundred yards apart this stopping would be no inconvenience to passengers, and would be well worth a trial. It would certainly give the streets more carrying capacity, and would be less distressing to the horses.

Another point is the setting aside of a part of the road for bicycle traffic. This is a very difficult question. There is no doubt that cyclists as a rule always try to keep as closely to the curb as possible—in fact, in both town and country the 3 ft. next to the curb or to the footpath may be called the cyclists' track, but, unfortunately, this space is very frequently

occupied by both heavy and light horse drawn vehicles drawn up for delivery of goods or setting down passengers, and in some cases the road authorities very frequently deposit on this space the mud scraped off the road in order to save themselves the expense of sending around the carts immediately after the mud is scraped together. This practice may easily be stopped. It is very hard on cyclists, and actually dangerous at night time.

As regards traffic on country roads, the law as to riding or wheeling a cycle on the footpath ought to be amended. A cyclist should be allowed to wheel or even ride his machine on the footpath in cases where the road is impassable by neglect, under repair, or otherwise in a condition which will damage his cycle, provided always that the cycle is led or ridden at a speed and in such a manner as not to cause danger or annoyance to foot passengers. There are many thousands of miles of footpaths in the country districts of England which are rarely used by foot passengers, whereas the total amount of damage and hence the money wasted by cyclists who are compelled to risk great damage to their tires by wheeling or riding them over sharp road metal is enormous. Road authorities ought to do something in return for the advantages that they obtain from so large a share of traffic now being carried on pneumatic or other forms of tires made of soft material, as their extended use has enabled a large quantity of traffic to be carried with little or no wear of the road surface. In return for this they ought to be empowered to make regulations which will prevent sharp objects liable to puncture the tires remaining on their roads.

One frequent cause of accidents or puncture of tires is found at places where the road has been broken up for pipe laying, drainage or similar work. After the trench has been filled in no attempt is made to replace the road metal and roll in the loose stones.

It may appear Utopian to suggest that it should be made an indictable offense to leave any material in a public highway which could puncture pneumatic tires, but I think that the expense which would be put on to a road authority in keeping its surface clear would be amply compensated for by the great public convenience and the saving of damage not only to motor cars and cycles, but to the horses' feet. No one need leave broken glass, nails, thorns or other puncturing materials in a roadway unknowingly, and any such things that are really accidentally left there ought to be removed by the servants of the road authority within a reasonable time, and this can easily be done by a daily inspection of the road.

There are several other points connected with traffic to which I wished to call your attention, but my paper is already so long that I need only enumerate them in order that you may judge how easily improvements might be effected. First as regards omnibus traffic. Omnibuses should not be allowed to swing right out at an angle to the road at the time they start. It is now a regular habit of the omnibus drivers to suddenly swing their horses across the road in order to pull out from the near curb. This, of course, blocks the road for the time. At regular omnibus stopping places the blocks caused in this way are intensified by more than one omnibus doing it at the same time. The police should insist upon omnibuses starting one at a time. I have pointed out the great advantages of every one keeping as close to the near side as possible. In overtaking from the near side automobilists are now subject to considerable risk from the driver's whip of the overtaken vehicle. Drivers, especially those of covered vans, who cannot see readily what is overtaking them, have the habit of swinging their whips out to the off side to lash their horses. This practice, from which I in common with most cyclists have suffered, ought to be absolutely forbidden. No one should be allowed to swing the lash of his whip to the off side of his vehicle.

I have shown how small is the carrying capacity of a tramway as compared with an undisturbed smooth surface roadway. I am strongly in agreement with Mr. W. Worby Beaumont on this point. Now that we can have good wood pavements, and that automobilism will soon become the rule instead of the exception, the tramway is an anachronism. The tramway is all very well for a new country where the roads are bad, but when a town like London has perfected roads, tramways should not be tolerated. I think all automobilists ought to combine to educate the public and the local authorities on this matter. The traffic can be carried better, safer and cheaper by automobile vehicles on a smooth asphalt road than on a tramway, whether the latter be electrical driven or not. Again, there is a dangerous practice against which cyclists, owners of light horse drawn vehicles and all automobilists ought to strongly protest, and that is the dangerous practice of watering the groove of the tramway in order to clean it and reduce the friction of the wheel flanges. The number of accidents that occur to cyclists due to side slip at this part of the road is enormous, whereas the selfish advantage to the tramway company is comparatively trifling in extent.

THE DISCUSSION.

Mr. Roger Wallace, in proposing a vote of thinks to Mr. R. E. B. Crompton for his excellent and instructive paper, remarked upon the unselfish manner in which the author had dealt with the question of the supercession of electrical and other tramways by automobile traffic. He thought Mr. Crompton had hit upon an important point in his remarks upon the extreme disadvantage of tramways when and where level smooth roads were obtainable. With regard to the carriage of the immense population of London from the city to the suburbs, and vice versa, he believed that such transport could and would be effected much more conveniently to all concerned upon the roads than by any other means. No one had hitherto pointed out so clearly as had Mr. Crompton the capacity of the existing roads for the performance of this duty. It must not be forgotten that the question of traffic was of paramount importance to the great city of London and to the empire. If Mr. Crompton's proposals could only be given careful consideration by the authorities he felt sure they would result in great advantage—an enormous commercial advantage—to this and other cities. In touching upon the question of the speed of traffic, Mr. Roger Wallace referred to the speed of the Paris traffic as being dangerous to the foot passengers, but he thought that the question of speed required more consideration by the authorities. The increase of population made speed increase essential. If such an increase were not allowed an enormous expense would have to be incurred in widening our streets. Therefore, the only way out of the difficulty was to increase speeds. Mr. Crompton had shown them how speed could be increased without danger, the question residing altogether in the stopping capacities of vehicles. The introduction of the automobile meant increased speed without further danger to the public. Mr. Crompton had gone most carefully into the legal aspect of the question; he feared that he must have digested reams of acts of Parliament to have put the matter so thoroughly. He hoped

the paper would reach the hands of Sir Edward Bradford and other authorities dealing with traffic.

Dr. Playfair, after acknowledging the interest and ability of the paper, said that the users of the streets carried their lives in their hands by reason of the bad regulation of the traffic generally. In driving about London in the afternoon one was constantly in the greatest peril from what he could only call "Van Demons." Relying entirely upon their bulk they went trotting gaily along obtruding themselves upon the streams of lighter traffic, and never dreaming of slackening their pace or pulling up for the convenience of others. Then he considered the prevalence of covered vans, in which the driver could not possibly see what was on either side or behind him, a constant source of accident. He would suggest that these huge vans and such heavy traffic should not be allowed to move in the main streets during the afternoon when the light passenger traffic was most frequent.

Mr. Wallace then read a letter from Mr. Henry Sturmey, which ran as follows:

Dear Mr. Johnson: I regret that circumstances will prevent my being at the meeting this evening.

Through the courtesy of Mr. Crompton, however, I have been able to peruse his very interesting and very valuable paper, and I would like to say I consider he has gone straight to the root of the matter in (1) the street wasting which now goes on through drivers taking a straight course which will lead them outside the standing vehicles, and (2) the stand he takes on the question of ability to stop the vehicle. This is undoubtedly the strong point of automobilism, and, not only this, but is really the bottom of the whole question of the safety of the public. So long as the safety of the public is conserved, the actual pace traveled really does not matter. As Mr. Crompton points out, the faster we travel the better will it be for the general public, and the more will the congestion of traffic be relieved, but, after all, safety comes down to the question of ability to stop.

With regard to Mr. Crompton's suggestion that furious driving should be decided by the amount of space the vehicle is actually stopped in when called upon to do so, this is a good suggestion, though I can see one objection to it: It is that misconceptions may arise and injustice be done through the policeman reckoning the distance from the point at which the car is when he holds up his hand, whereas, the driver may not see the signal, or appreciate its purport, for a second or two—at any rate quite in sufficient time to make all the difference between stopping in the prescribed space and otherwise. If some means could be taken for absolutely measuring the distance taken to pull up in from the moment the driver applies his brakes, we should, of course, have an absolute record to go by. Your faithfully,

Henry Sturmey.

Mr. W. R. S. Erskine thought Mr. Crompton had missed one or two points. With regard to the traffic holding close to the near side of the road, that in the summer at all events was not possible, as the authorities made a practice of having the sides of the roads watered, which made the surface so dangerous for horses that the traffic was obliged to move further out. He thought if Mr. Crompton's proposal were to be carried out the watering arrangements would have to be altered.

Mr. Charles Hawksley thoroughly indorsed the remarks of the previous speaker, and in referring to the restriction and regulations for heavy traffic suggested that wherever streets parallel to the main thoroughfares existed the heavy traffic should be obliged to proceed by such routes. This would largely relieve the main thoroughfares in many parts.

Mr. Weaver, the surveyor to the Kensington Vestry, was then called upon, and in reviewing the many plaints of the lecturer and the previous speakers, said that so far as the road authorities went they were in the difficult position of fitting one system of road cleansing to many sets of circumstances, and gave instances of sudden changes of weather in illustration of his contentions. In the matter of making safe roads during frosty weather a sharp, crushed grit was generally employed, and this was found the best under all circumstances for the horses. But for himself he recognized that a very large number of the rate payers were users of vulnerable rubber and pneumatic tires, and in consideration of the fact that they had a right to be safeguarded he had employed no less than three different kinds of material to meet the different requirements. Indeed, he was now sanding the roads three times with fine sand, whereas once with the crushed grit would have been sufficient. With regard to the question of watering, it was known that the best road to travel on was an unwatered road, but the road users were not the only people who had to be considered in this matter. The shop keepers required consideration, particularly those who illegally displayed their goods upon the pavement rather than within their shops. If the roads were not properly watered in summer time there was soon an infuriated butter man making an awful row because the last tub of his extra best Dorset was covered with dry horse dung. So in Kensington they had adopted the method of only watering the roads with the half spray where there were no shops, and of wholly watering them where there were. He explained, by reference to the cost of cartage, barging, etc., that the retention of slop at the sides of the roads was merely a question of cost. There was no doubt that our streets were terribly overcrowded, and in his opinion the remedy for such overcrowding was motor traffic. Indeed, horses were at the bottom of all the nuisance. If horses were eliminated from the streets, the roads from one end of the city to the other could be paved with asphalt, which was the most hygienic form of road pavement. It was due to horse employment that we had such a hotch potch of pavements in the London streets to-day. The disappearance of horses from the streets would bring about such a change in London that it was inconceivable, except to those who were aware of the amount of filth taken off the London streets every day. The sanitation of the city would be immensely improved, rates would decrease, and the public would be better off both in health and pocket. He considered the great hindrance to traffic resided in the cheap omnibuses. By the putting down of well-made, smooth roads it was possible for cheap omnibuses to be run at a profit, so that, indeed, the highly rated folks were, in fact, paying a part of the fares of those who traveled in omnibuses. The swarms of omnibuses blocked the road to other traffic, so that the people in carriages who were stopped and hampered really were paying a considerable portion of the fares of the folk whose conveyances were belating them. Omnibuses should only be allowed to pull up at stated points, and precedence should be arranged by taking tickets, as in Paris. The struggles to board omnibuses at such places as Piccadilly were disgraceful. Indeed, he had often seen an economically minded lady spoil 5 shillings' worth of dress in her struggles to get a penny ride. (Laughter.)—The Autocar.

(*To be continued.*)

MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 639,490—Dec. 19, 1899—Automobile.—Thomas R. Almond, Dunwoodie Heights, N. Y.

The inventor introduces a coiled pipe connection between the hydrocarbon reservoir and the generator, and his single claim is as follows:

In a vehicle, the combination of a reservoir and a burner or generator mounted upon the said vehicle and adapted to oscillate with respect to each other, of a continuous laterally flexible coiled piping intervening between the said reservoir and the said burner or generator and united to the said reservoir and burner or generator by rigid joints.

Application filed Oct. 16, 1899.

No. 639,775—Roller Thrust Bearing.—Winfield S. Rogers, Boston, Mass., assignor to the Ball-Bearing Co., same place. Filed Aug. 26, 1899. Serial No. 728,538. (No model.)

Claim.—In a roller bearing the combination of a disk having through it several series of rectangular mortises with their major axes radial to the axis of the disk, the mortises of each series being arranged in spiral order and the several spiral series overlapping each other, a cylindrical roll disposed loosely within each mortise and adapted to engage the end of the side walls thereof and a flat disk at each side of said disk and engaging said rolls.

No. 639,548—Dec. 19, 1899—Variable Speed Driving Gear.—T. C. Field, Southampton, England.

This is on the well-known lines where in a train of epicylic train or "sun and planet," in gear one toothed wheel being held or locked causes another wheel to impart a speed in excess of the driven wheel.

Two claims. Application filed April 10, 1899.

No. 639,400—Dec. 19, 1899—Vehicle Tire.—E. Kempshall, of Newton, Mass.

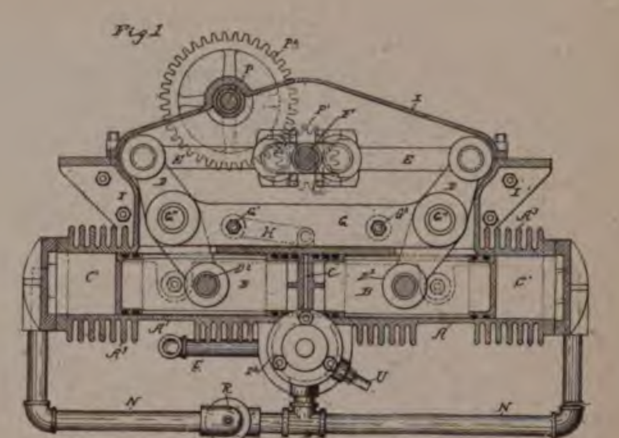
This is an improvement in tires for use on heavy vehicles and is well described in the inventor's second claim, which is appended hereto:

A tire comprising an inner yielding member formed with an air chamber and a valve stem integral with the walls of said air chamber, said member being confined and backed by an inner tube of reinforcing fabric, an exterior inclosing envelope composed of a rubber facing backed and supported by an outer tube of reinforcing fabric, a motion-absorbing rubber cushion adjoining the inner fabric tube, a motion-absorbing rubber cushion adjoining the outer fabric tube, and an intermediate tube of reinforcing fabric between the said cushions, the said tubes being separately formed and the parts vulcanized together.

Three claims. Application filed June 27, 1899.

No. 639,686—Dec. 19, 1899—Fluid Pressure Engine.—A. F. Parks, of Dayton, O.

The purpose of the invention is to provide an internally balanced engine in which a maximum power is obtained from



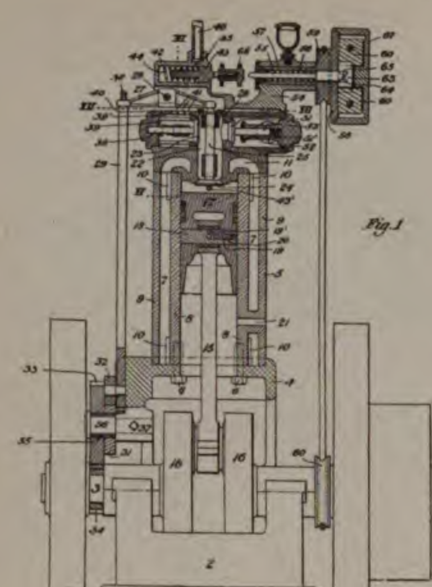
the explosive mixture, the entire engine occupying a minimum space. The general scheme in operation is outlined as follows:

The operation of the engine is what is known as the "Otto cycle," with the following modifications: Upon the admission, compression and ignition of the explosive mixture in chamber C the rise of pressure forces the pistons to their extreme outward positions. At this moment the exhaust valve M is opened, permitting free communication between chambers C and C'. At this time there is in chamber C in one cylinder and in chamber C' in the two cylinders a certain pressure per square inch. This gives a pressure on two pistons tending to move the same in one direction and on the four pistons tending to move the same in opposite directions. This unbalanced force will therefore move the pistons toward the center of the engine, thereby exhausting the gases from chamber C into piping N and chambers C'. When the pistons have arrived at the inner end of their stroke, valve M closes and valve R opens, allowing gases in the piping N and chambers C' to be forced out to the atmosphere by the next outward stroke of pistons. While this cycle of operation has been existing in one cylinder on the stroke corresponding with the first expansion stroke, explosive mixture has been drawn into chamber C in the other cylinder. On the next inward stroke this mixture is compressed and exploded when the pistons reach their extreme inward positions. The next outward stroke is the expansion stroke for this cylinder. Exhaust valve M, connecting said cylinder with the system of piping N and chambers C', is open at the outward limit of said stroke, allowing upon the next inward stroke the expulsion of the gases from the chamber C into piping N and chambers C'. The exhaust valve M for this cylinder then closes, the secondary exhaust valve R is opened, and the gases are expelled into the atmosphere by the next outward stroke of the pistons.

Eight claims. Application filed June 12, 1899.

No. 639,683—Dec. 19, 1899—Gas Engine.—Arthur H. Neale, Beaver Falls, Pa.

Referring now to the drawings, 2 is the base of the engine, provided with suitable bearings for the main shaft 3, carrying the usual fly wheel and pulley, while the base is extended upwardly to form a support 4 for the cylinder 5, secured to it by bolts 6. The cylinder is provided with a water compartment space 7, intervening between the inner and outer walls 8, 9, the space extending from top to bottom of the cylinder and completely around it, while at top and bottom are intervening bridges 10, which serve to maintain the inner and outer cylinders in rigid relation to each other and to provide metal for insertion of the bolts. In the top of the



cylinder is formed a circular chamber 11, registering with space 7 and contracted around the inlet valve.

A circulation of water is maintained through the water chamber by pipe 12, leading from the base of a water tank 13, while outlet pipe 14, leading to a higher level, discharges the heated water into the tank, the circulation being induced by the rise of the water as it becomes heated by contact with the cylinder. A pitman 15 connects the cranks 16 with the piston 17, which is mounted within the interior of the cylinder constituting the explosion chamber.

For the purpose of oiling the pitman bearings in the piston the pin 18 is made hollow by port 19 through its center at one side, with a branch port 19' leading up into the bearings. Inside the port 19 is a spring-controlled valve 20, and when the piston is at the bottom of the stroke the port 19 comes into register with port 21 through the cylinder, into which the nozzle of an oil can may be inserted, displacing the valve and oiling the joint.

Located centrally above the cylinder is a chamber 22, into which opens the gas and air inlet valve 23 and from which the mixed gas and air pass into the explosion chamber downwardly through valve 24. This valve is mounted on stem 25 and is normally held closed by spring 26. A lever 27, pivoted at 28, bears on the upper end of stem 25, while the opposite end bears on the upper end of an actuating rod 29, the lever being provided with a set screw 30, bearing on the upper end of rod 29, by which all wear is taken up. The rod 29 is raised at each alternate revolution by means of cam 31 riding under roller 32 on the lower end of the rod, the cam revolving with a toothed wheel 33 in mesh with and of double the diameter of a driving pinion wheel 34 on the main shaft. The gear 33 and cam 31 are mounted on a bushing 35, of brass or other non-frictional metal, surrounding a stud, 36, eccentrically enlarged for taking up wear, held by a set screw in a depending lug 37 of the main frame. The inlet valve 23 is mounted on the end of a stem 38, having a bearing in a hollow shell 39, inserted into a mixing chamber 39', screwed into the head of the cylinder 40 and reduced in diameter, so as to leave a surrounding communicating passage for the gas, while the opposite sides are open to further facilitate their passage. Into this valve chamber open the several air ports 41, leading downwardly from the upper face of the head, their location being concealed and protected by the gas valve chamber 42, immediately above. In this chamber is a reciprocating valve piston, 43, adapted to be held open normally by pressure of spring 44, admitting gas through port 45 from pipe 46, leading from any source of supply. At each side of the valve are ports 47, by which the gas is conveyed downwardly into the valve chamber 39'.

Ten claims. Application filed Aug. 15, 1898.

No. 639,237—Dec. 19, 1899—Motor Carriage.—F. C. Hirsch, New York, N. Y.

The general design is well suggested by the inventor's claims, which follow:

1. In a motor carriage the combination of the duplex motor secured to the front axle, the driving axle operated by said motor, pulleys of different diameters secured rigidly to said driving shaft, belts for connecting said pulleys with pulleys of different diameters rigidly secured to a countershaft, said countershaft, means for transmitting power therefrom to a driving wheel turning loosely upon the power shaft, and means for throwing said belts into action independently, substantially as set forth.

2. In a motor carriage the combination of the duplex motor secured to the front axle, the driving axle operated by said motor, two drive wheels mounted loosely upon opposite ends of said driving shaft, two sets of pulleys of different diameters secured rigidly to said driving shaft, two countershafts situated on opposite sides of the motor and provided with corresponding pulleys of different diameter, belts connecting the opposed pulleys on the driving shaft with those upon the countershafts, means for transmitting power from said countershafts to their respective drive wheels, and means for throwing said belts into action independently, substantially as set forth.

Application filed April 12, 1899.

No. 639,399—Dec. 19, 1899—Vehicle Tire.—E. Kempshall, of Newton, Mass.

The improvements are fairly summarized in the fifth claim thus: A cushioned three-part vehicle tire comprising an inner yielding member backed by a reinforcing fabric, an outer envelope backed by a reinforcing fabric and having an outer tread face, a substantially flat inner face, and oppositely inclined or beveled sides between the inner and outer faces, said sides imparting a wedge form to the cross section of the tire, and an intermediate motion absorbing cushion interposed between and united with said reinforcing fabrics, the said reinforcing fabrics extending inwardly between the beveled sides of the tire.

Nine claims. Application filed Nov. 27, 1899.

No. 639,385—Dec. 19, 1899—Regulating Valve for Gas Motors.—Max E. Hertel, of Greenfield, Mass.

This is divided out of the pending gas motor application filed May 16, 1898, and relates to a single valve device for regulating the quality and quantity of the gas and air mixture admitted to the motor cylinder.

Four claims.

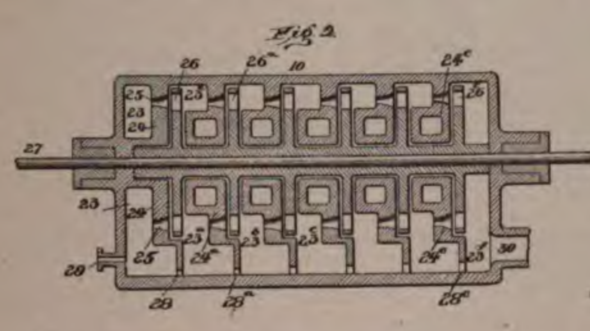
No. 639,256—Dec. 19, 1899—Change Speed Gear.—Ralph Lucas, of London, England.

This device employs expansion pulleys, whose faces are composed of bars arranged on a lazy-tongs plan, springs are so attached as to have a constant enlarging action upon the circumference of the pulleys.

Five claims. Application filed July 17, 1899.

No. 639,394—Dec. 19, 1899—Superheated Water Motor.—Maurice Hutin and Maurice Leblanc, of Paris, France.

The improved motor is shown in the drawing and the general theory of the inventors is submitted as being based upon the following considerations: In ordinary motor systems with superheated water the reservoir containing the latter is



tapped for consumption at the steam space above the level of the water, so that the motors receive from the reservoirs steam which is ordinarily of too high pressure to be utilized in that state and which is therefore first led to an expansion chamber, where the pressure is diminished, and from which the steam is conveyed to the motor proper. In some cases the expansion chamber was dispensed with and the steam was directly led to the motor from the hot water reservoir. In either case, however, the gradual abstraction of water from the reservoir in the form of steam rapidly cooled the superheated water down to a temperature at which it would not any more generate steam with the requisite pressure. This reduced critical temperature was in all cases reached when only a comparatively small portion of the superheated water had been consumed. When this point was reached, the reservoir had to be replenished. Thus, while the initial charge of the reservoir represented, theoretically, a large amount of mechanical power, only a comparatively small portion of it could be utilized, the remainder being wasted in the conversion of the water into steam. In all these cases the waste of power due to radiation from the reservoir represented only a very small fraction of the actual loss.

In acordance with our improved system we avoid practically all loss of useful energy due to consumption of heat by the withdrawal of the superheated water from the reservoir in the form of steam, in that we tap our reservoir below the level of the water, and thus carry the latter in liquid form to the motor or motors and there cause it to flash into steam by the use of an expansion chamber, which is preferably a part of the motor construction and in which motor the expansion of the steam itself is directly utilized. In this manner the reservoir and its contents are not cooled by evaporation, and but for the trifling loss due to unavoidable radiation the charge in the reservoir would remain very nearly constant from beginning to end.

It is to be understood that we use what we may in a general way call the "dry steam" obtained from the expansion of superheated water at or in the motor instead of using a mixture of superheated water and steam projected against the moving part of the motor, for by using the steam only acting against the movable part of the motor there is a notable gain in efficiency due to the fact that the steam is utilized under conditions best adapted to transform its energy of heat into motion. It will also appear that we thus, in effect, use an expansion chamber for the superheated water, which is applied to the motor itself, which expansion chamber preferably forms part and parcel of the construction of the motor. Such construction has all the advantages above pointed out and is, in fact, a most important feature of our invention. The above parts of our invention, as will be clear, are not limited to the rotary or multicellular type of motors which we hereinafter specifically describe.

As regards another part of our invention, it consists in a compound engine, specifically and preferably a multicellular steam turbine, so arranged that the charges of superheated water entering the first cell and partly flashing into steam passes both by a steam port and by a water port to the next succeeding cell, so that the steam spent in the first cell will enter successively the next succeeding cells, together with so much of the water as had not yet been converted into steam. In each cell is a turbine wheel and all wheels are keyed to a common shaft.

In each cell of the engine just described the steam acts against the movable part of the turbine to drive the said movable part and then passes on to the next cell. The diminution in the pressure of the steam as it passes from cell to cell which is thus occasioned is compensated for in part by the formation of steam from the superheated water which flows by the separate water port into the successive cells. Steam alone acts on the movable parts of the engine or turbine. The superheated water flowing by a separate passage merely tends to keep up the steam supply.

Eight claims. Application filed Nov. 30, 1898.

No. 639,541—Dec. 19, 1899—Automobile Vehicle.—F. L. Dyer and L. H. Dyer, Washington, D. C.

This is a very ingenious and comprehensive effort along the fluid transmission line, to which many inventors are just now directing their attention.

The various modifications to be described relate particularly to the means employed for varying the speed and direction of rotation of the motor.

In the drawing 1 is the explosive engine, 2 the pump, and 3 the motor. The column of liquid is shown at 4.

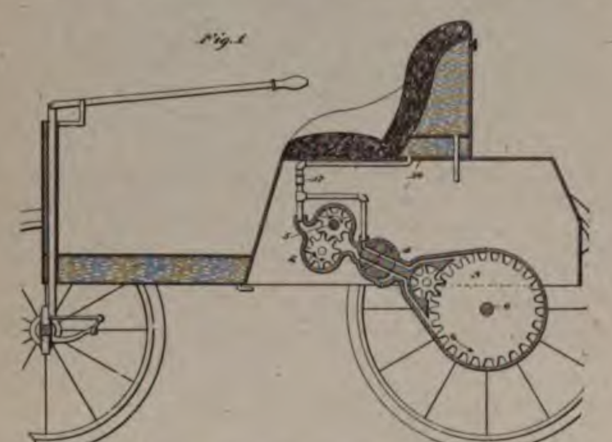
5 is the shaft of the engine, which in all the figures is shown as connected directly to the pump, and 6 is the driving shaft of the vehicle, which in all the figures is shown connected directly to the motor.

Having reference to Fig. 1, the direction of rotation of the pump (which is of a common type) being shown by arrows, the column of liquid will be forced in the direction indicated by the arrows and will be delivered to the motor rotated in the direction indicated to drive the vehicle forward.

In order that the speed of the motor may be varied independently of the pump, a portion of the liquid between the pump and motor is shunted off through a by-pass. This is best accomplished by means of a suitable valve or valves, that shown in Fig. 1 being preferred. This valve comprises a hand-operated barrel, 7, having passages, 8, 9 and 10, therein, and a by-pass, 11, in line with the port 10 and to one side of the ports 8 and 9. The exit and inlet ports 12 and 13 from and to the pump are sufficiently deep to align with both the ports 8 and 9 and with the by-pass 11.

In Fig. 1 the valve is shown as forming a passage directly to the motor, which runs in an opposite direction to that of the pump. On the valve being turned in the direction of the arrow at the outside of the casing the ports 8 and 9 will be moved away from the inlet and outlet ports 12 and 13 so as to gradually close the clear passage from the exit 12 of the pump to the inlet 14 of the motor. At the same time the

by-pass 11 will be slightly opened to accommodate the balance of the liquid not passing to the motor, which will then pass from the exit 12 directly to the inlet 13 of the pump. This movement of the valve may be continued to gradually shunt the liquid from the motor, and thereby gradually decrease its speed and at the same time to gradually increase the amount of liquid shunted through the by-pass, so that it passes directly from the exit to the inlet of the pump. The by-pass will be entirely open and the ports 14 and 15 to and from the motor completely closed in the position shown in Fig. 4, wherein all the liquid will be shunted through the by-pass, and since the exit and inlet to the motor are completely closed the motor will be securely locked against rotation. In this position of the ports the pump can be rotated without resistance other than that required to move the liquid through the by-pass. The explosive engine can therefore be



readily started by giving it a few turns with the hand and allowing it to rotate freely, and it will continue to rotate, even though the motor is entirely stopped. Further movement of the valve will gradually close the by-pass, where the passages to and from the motor will be crossed or reversed, causing the motor to run in the opposite direction at full speed.

The valve shown may be connected to a hand-operated lever arranged in any convenient position adjacent to the operator.

In order to provide for any leakage of the liquid either through the motor or pump, we prefer to employ a tank or receptacle, 16, located above the pump and supplying liquid thereto, and in the pipe connecting said tank with the pump we prefer to interpose a check valve, 17, by which will be prevented the forcing of the liquid from the driving mechanism into said tank. This check valve is of use principally when the vehicle is running down hill, and it prevents the motor acting as a pump from forcing liquid into the tank 16. In this way we maintain the liquid column always between the pump and the motor, so that the speed of the motor will be the same whether it receives power from the pump or delivers power to the pump on steep inclinations.

In Fig. 1 we illustrate the tank or receptacle 16 as being located immediately beneath the cooling water tank which supplies water for cooling the explosive cylinders, and it is well understood that the cooling water itself may be used in the liquid column. In said figure we also illustrate in front of the seat, beneath the floor of the vehicle, an oil tank for containing oil or other fuel for the explosive engine.

The device which we have just described constitutes a simple form of driving mechanism embodying our invention; but we prefer to use instead of the by-pass just described a pump having a variable capacity or a motor having a variable speed with a constant feed.

Thirty-eight claims. Application filed May 4, 1897.

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

FOR SALE.

Gasoline carriage, 4 h. p. well-balanced motor. In successful operation.

S. S., care of HORSELESS AGE.

FOR SALE.

United States rights under valuable patents on solid rubber tires for automobiles and horse carriages of any weight.

Address BANDAGE, care of HORSELESS AGE.

FOR SALE TO ANY ONE.

A Stanley Locomobile, No. 1 Stanhope Model, in perfect condition. Has been run 450 miles. Full printed instructions. W. E. JACKSON, JR., P. O. Box 604, Augusta, Ga.

CHAS. F. SCHAEFFER, 811 Drexel Building, Philadelphia, Pa., Draughtsman and Machine Designer. Detail drawings made for motors and mechanical parts of motor vehicles. Working drawings made from sketches.

Drive Chain,
SPROCKETS.
GEARS. 3,200 Sizes.
Compensating Gears. Steel Balls, etc. . .
Boston Gear Works,
138 Purchase St., BOSTON MASS.

Seamless Cold Drawn Steel Tubing, Shells, Cylinders and Tanks, For Air, Gas, Steam, Ammonia or fluids under pressure and explosives. ☞ Seamless Steel Tested Tanks of Sundry Diameters.

DROP FORGINGS AND STEEL STAMPINGS.

JANNEY, STEINMETZ & CO., Drexel Building, Philadelphia, Pa.

DRY BATTERIES
For Sparking Gas and Gasoline Motors.
LONG LIFE, RELIABILITY, HIGH VOLTAGE.
IN SUCCESSFUL USE FOR THIS PURPOSE.
Dow Portable Electric Assistant Co., 218 TREMONT ST., BOSTON, MASS.

LEONARD HUNTRESS DYER,
Specialty: Patents and Patent Causes,
908 G Street, N. W.
Cable Address: "Dyerpatent, Washington." **WASHINGTON.**

GASOLINE ENGINE CASTINGS.

One to four h. p., for stationary marine or vehicles; rough or partly finished. Also complete engines, carbureters and accessories. LOWELL MODEL CO., Box 292, Lowell, Mass.

BALDWIN DETACHABLE CHAINS made for Automobiles, in sizes to suit all requirements. Prompt deliveries made. Address:
BALDWIN CYCLE CHAIN CO.,
WORCESTER, MASS., U. S. A.

THE JUMP SPARK LEADS
Give Thick
1 Inch Jump Spark.
Weight, 3 lbs.
Dimensions, 8 x 4 x 4 ins.
Patent Applied For.
C. F. SPLITDORF, ELECTRICAL SPECIALTIES,
21 Vandewater St., New York

AUTOMOBILE CHARGING AND REPAIR STATION
We Make, Rent, Recharge and Repair
STORAGE BATTERIES.
THE STORAGE BATTERY SUPPLY CO.
Established 1891. Telephone, 1065 Madison Square. Incorporated 1898.
OFFICE AND WORKS: 239 East 27th St., New York City.

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of THE HORSELESS AGE, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

WANTED.

Special contributors to THE HORSELESS AGE on all important subjects relating to Motor Vehicles. Fair compensation. Address THE HORSELESS AGE, 150 Nassau Street, New York.

MUD, DUST AND DIRT

Will soon ruin gears and other running parts. Protect them with . . . . .

ALUMINUM CASES

We make them in large quantities. Write us. All kinds of Aluminum Work. .

THE HILL, WHITNEY & WOOD CO., 115 Bacon Street, Waltham, Mass.

FELTED RIMS FOR PNEUMATIC TIRES.

The annexed cut illustrates the application of a protecting strip on the edge of Rims, as a protection to the Pneumatic Tires, preventing the wearing or cutting of the outer edge of the Tire.

Price List and particulars on application to

THE COLONIAL AUTOMOBILE CO.
32 Hawley Street, BOSTON.

HAND AND POWER PUMPS For Users and Makers of Automobiles and Pneumatic Tired Wagons . . . . . .

GLEASON-PETERS AIR PUMP CO.,
MANUFACTURERS,
20 WEST HOUSTON STREET, NEW YORK U. S. A.

EXPLOSIVE MOTOR NUMBER.

TO be issued January 17th. Dealing thoroughly with gasoline, kerosene, alcohol, etc., vehicle motors and motor vehicles. Leading articles by **R. I. Clegg, E. J. Stoddard, P. M. Heldt, Herbert L. Towle, P. L. Tygard** and others. **Seventy-two pages,** many illustrations. **Ten cents,** stamps or coin. **Subscription:** Domestic, $2.00 ; foreign, $3.00 a year in advance.
☞ Send for our **STEAM BOILER NUMBER OF DECEMBER 6, 1899,** 10 cents.

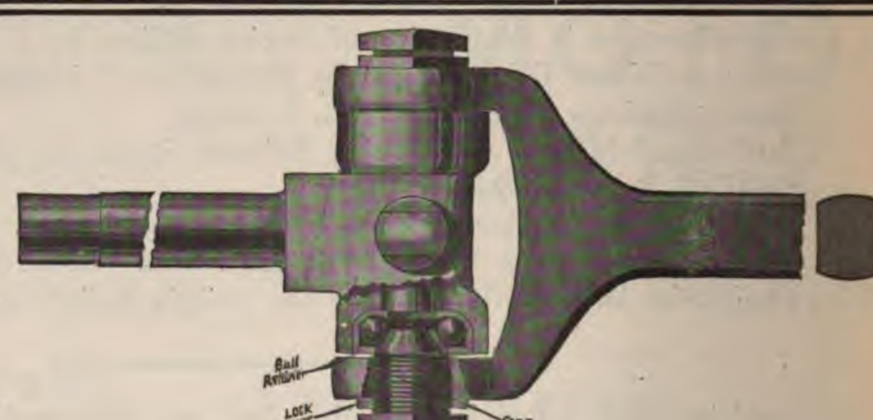
THE HORSELESS AGE, 150 Nassau Street, N. Y. WEEKLY ESTABLISHED 1895

.....THE MOTOR TIRE.....

that has given the best satisfaction. It's been tried under all conditions and we have yet to receive a complaint.

WRITE FOR PRICES AND CATALOGUE.

THE GOODYEAR TIRE & RUBBER CO., Akron, Ohio, U. S. A.



Ball Retainer
Lock Nut
Cone

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. V. NEW YORK, JANUARY 10, 1900. No. 15.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

Need of Standard Types.

The editor is constantly in receipt of letters from parties in different sections of the country who wish to purchase motor stages of various capacities and styles. Some of these inquirers name a seating capacity of 20 or 30, which is beyound the limit at present reached by American motor vehicle manufacturers. So far as the editor is aware no maker is now prepared to furnish vehicles carrying more than six or eight persons, and some little time is generally demanded for the proper execution of an order of this kind. The pressure of demand is such, however, that eariler deliveries may soon be hoped for, if those seeking such vehicles will modify their specifications to approximate to standard types which can be more quickly and cheaply produced.

Equal Rights Upon the Road.

John C. Higdon, the St. Louis automobilist who is being sued for damages on account of an accident due to a horse his machine is said to have frightened, requests that parties who are having or have had a similar experience communicate with him at once in order that he may have the benefit of their experience in court. He may be addressed Union Trust Building, St. Louis, Mo.

Mr. Higdon should receive the support of the entire motor vehicle fraternity in his fight for equal rights upon the road.

Chauffeur Heavily Fined in France.

The determination of the Paris authorities to repress the ardent chauffeurs who have been imperiling the lives of the citizens by running their carriages at reckless speeds is well exemplified in the Herald's cable dispatches of yesterday. No less a person than a Count was sentenced to two months' imprisonment and fined $1,500 for breaking a lady's leg through his careless driving in the Bois de Boulogne.

The sentence seems severe for a first offense under the new law, but the chauffeurs have disregarded repeated warnings of the hostile sentiment that was growing in the public mind in consequence of their reckless driving, and one or two examples of this kind may be necessary to remind these impetuous gentlemen that the streets belong to the public. Heroic measures are sometimes justified, and this seems to be one of the exceptional cases where it is necessary.

Horses vs. Motor Accidents.

The Velo, a leading French bicycle and sporting paper, states that in France during December there were 708 accidents—52 deaths and 656 injuries—due to horses, and only 21 automobile accidents (causing one death) in the same period.

This comparison would be more complete if some idea were given of the relative number of horses and automobiles in the country.

Explosive Motor Number.

Among the leading articles which will appear in our Explosive Motor Number of Jan. 17 may be mentioned: "Vibrations in Explosive Motors," by Herbert L. Towle; "Multi-Cylinder Engines," by P. M. Heldt; "Ignition and Ignition Troubles," by P. M. Heldt; "The Fuel Field," by P. L. Tygard; "Explosive Mixtures," by E. J. Stoddard; "Spark Coils," by the same author; "Practical Data and Working Drawings of Small Gasoline Motor," by R. I. Clegg, and numerous other leading articles whose titles have not yet come to hand.

The Explosive Motor Number will be even more valuable in its particular branch of the subject than the Steam Boiler Number, because the explosive motor is newer than the steam motor, and original investigation therein is not so easily obtained.

Cycle and Automobile Show.

The management of the show wish to notify exhibitors that goods sent to the show must be marked with the name of the consignor and the number of the space, addressed to the Madison Square Garden, New York City, and that goods will be received only at the Fourth Ave. and Twenty-seventh St. entrance, where a receiving clerk will take charge and send a printed notice of the arrival of the goods to the space for which they are marked. Charges of all kinds must be prepaid. The show will be opened from 10 a. m. until 10:30 p. m. each day from Saturday, Jan. 20, to the following Saturday, exclusive of Sunday. Storage for goods can be secured in the exhibition hall.

With each rented space there is given five coupon books containing four admissions for each day of the exhibition, being equal to 140 admissions for the entire period of the show. These admissions are good for exhibitors and gentlemen only, and are to replace the exhibitors' buttons formerly used. Special tickets, if required, will be issued for ladies. Any regular qualified bicycle or automobile agent, manufacturer, exhibitor or employee of exhibitor will be admitted to the Garden free from 9 a.m. to 1 p. m., by giving his name and address at the Bureau of Information when entering.

Lead-Zinc Accumulators.

The fact that when the negative or spongy lead plate of the usual lead accumulator is replaced by zinc, the electro-motive force obtained is considerably higher, being about 2.5 volts, has long been known, and accumulators of this kind have frequently been made; but as far as we can learn they have as frequently been abandoned. The difficulties seem to lie in preventing the zinc from being dissolved by local action, when the cell is not in use, and in the proper disposition of the dissolved zinc on re-charging, as it is apt to develop growths which gradually extend from one plate to the other. Nevertheless the high voltage and the lightness of the cell have been very tempting to inventors. A recent report of a form of this cell devised by Leitner, in the Elektrotechnischer Anzeiger, states that a small, round cell weighing only 3 lbs. will yield about nine hours of discharge at a constant current of about 2 amperes, the voltage falling from 2.56 to 2.1 and the average being 2.34. This corresponds to about 18 ampere-hours or 42 watt-hours per cell, which is at the rate of 5.6 ampere-hours or 13 watt-hours per pound of cell complete with acid. While these results are good, especially as it is a small cell, the report unfortunately does not explain whether the usual objections to these cells have been overcome; the figures therefore serve merely to show what capacity can be obtained. Another inventor of a similar cell overcomes the objection due to local action by emptying the retaining cell whenever the battery is not in use, which is done by having a second tank connected to the cell with a flexible pipe, and then raising or lowering it.—American Electrician.

Removed to New Jersey.

The American Electric Vehicle Co., formerly located in Chicago, Ill., has moved to a plant at Third and Clinton Sts., Hoboken, N. J. Of the reorganized company, J. Herbert Ballentine, of Newark, is president, C. E. Corrigan vice-president and general manager, and George L. Lister, of Jersey City, secretary and treasurer. New machinery is being installed and the factory will be in operation in a few days.

That Algebraic Formula.

Detroit, Mich., Jan. 6.

Editor Horseless Age:

By a clerical error or an error of the type the exponent $\frac{4}{3}$ or 1.33 was omitted from the factor V in my reply to the letter of J. F. B. in your issue of Nov. 22, 1899. Hence the just criticism of Prof. E. C. Oliver in your last issue.

If he will supply this omission, I think the difficulty will disappear. Respectfully yours, E. J. STODDARD.

The Grant Axle & Wheel Co., Springfield, O., manufacture a special hub which can be readily substituted for the ordinary hub of the Archibald wheel. They recommend metal hubs for wheel drive, and wood hubs when the driving is done from the axle. They furnish any kind of wheel with their patent axles, and have fitted up with special machinery to do their work to the best advantage.

The O. S. Kelly Co., Springfield, O., report orders for six steam plowing outfits on the English system, for deep plowing in sugar countries.

The Olds Motor Works, Detroit, Mich., are getting their new plant in shape as fast as possible, and expect to be ready for the market in the spring. They have two and a half acres of floor space, wharfage and every modern convenience to assist them in turning out stationary and marine motors and motor vehicles of all kinds.

LONDON NOTES.

London, Dec. 27.

During the past week the secretary of the Automobile Club has been going over the proposed route for the 1,000-mile trial which is to take place next spring. In view of the wintry weather of the past few days he has had a decidedly unpleasant trip.

THE LIVERPOOL SELF-PROPELLED TRAFFIC ASSOCIATION.

The opening meeting of the fourth session of the Liverpool Self-Propelled Traffic Association was held in Liverpool on Tuesday evening, the president (the Earl of Derby) in the chair.

Mr. Calthrop gave a short address on the subject of the tare regulations. One of the most important results of the trials was the demonstration of the very great difficulties under which British manufacturers labored in the effort to produce motor wagons which were, on the one hand, a mechanical and commercial success, and, on the other, which conformed with the law. There were immense improvements in the vehicles assembled at the trials this year compared with last year. The restriction in 1896 of the tare weight to the purely arbitrary limit of 3 tons had not been justified by experience since, or supported by any valuable considerations of public policy or safety. It was the duty of the association to do what it could to secure reform in that respect, and by raising the tare from 3 tons to 4 tons, to give fair play to their manufacturers.

Professor Hele-Shaw gave a bright and interesting description of the recent trials in Liverpool, illustrated by lantern slides, with very important and instructive deductions from the experiments and explanations as to the varying systems. All the exhibited vehicles were, he considered, deserving of awards for the excellent results they had in one way or another been able to achieve.

The Earl of Derby moved the adoption of the judges' report and a hearty vote of thanks to those gentlemen who assisted in the trials, especially mentioning the hard-working honorary secretary, Mr. Shrapnell Smith.

The Earl in his address pointed out that, while other automobile associations have devoted attention more to the lighter class of vehicle, the Liverpool Association had dealt with the problem of heavy traffic. He congratulated the association on the success which had already attended their efforts, and expressed belief that the movement was bound to succeed. He did not suppose motor wagons would ever supersede railways or even cartage by horse traction, but they had their own distinct mission, and he believed they would prove of enormous advantage, without in any way displacing existing interests. Having regard to the success which had attended previous trials, he hoped they would be continued, since it was proved that manufacturers and inventors had derived great benefit from them.

MOTOR VEHICLES FOR MILITARY PURPOSES.

It is definitely announced that as a result of the tests made in the recent manœuvres, the German military authorities have placed an order with the Daimler Motoren Gesellschaft for five motor wagons for transport purposes. The enterprise of the German War Department is in strong contrast with that shown by the British War Office, to whom one firm recently offered to allow a free trial of two motor lorries, but which offer was, I regret to say, rejected without comment.

MUNICIPAL MOTOR VEHICLES.

I have in previous letters referred to the enterprise which is being shown by municipal councils in the United Kingdom in the adoption of automobiles. The use of horseless vehicles in municipal work has now been brought to the notice of the Birmingham Health Committee, who are considering the expediency of adopting them for the Interception Department, which employs a large number of horses, particularly at night. The work is trying to the horses, and it is believed from the experience of other bodies that mechanical power would prove more economical. A deputation of five has been appointed to visit a London center where motor vehicles are in use.

Negotiations are in hand relative to the starting of a service of public motor wheels in the Windsor District. A similar proposal is under consideration at Aberdeen, the intention being in this case to compete with a projected light railway.

CONTINENTAL EXHIBITIONS.

Arrangements are in hand for the holding of an automobile exhibition in Amsterdam, Holland, from March 9 to 18 next. A motor car exhibition is also to be held in Nurembourg, Germany, in May next under the auspices of the Fränkische Automobile Club. The Mid-European Motor Car Club is also contemplating the holding of a second International Automobile Exhibition in Berlin in 1901.

MOTOR OMNIBUSES IN RUSSIA.

According to a report just to hand from St. Petersburg, Russia, two proposals to introduce a service of motor omnibuses in that city have been brought before the municipal authorities. One syndicate projects the starting of services of 15-seated gasoline motor omnibuses over four different routes—one to be started within a year and the other three within the following two years. The other applicants propose to introduce 14-seated vehicles, also propelled by gasoline motors, over no less than 12 routes.

Some experiments are at present being carried out by the German postal authorities with an electric postal van built by the Gesellschaft für Verkehrsunternehmungen, of Berlin. The van is running 18 miles per day and is said to be giving satisfactory results.

It is stated that ararngements are being made for the starting of a service of motor cabs in Carlsruhe. Die Automobile, of Berlin, also announces that a service of motor cars is about to be started between Veckerhagen and Münden. At Speyer, too, a company is being formed for a similar purpose, while in April next a service of motor omnibuses is to be inaugurated between Ilmenau and a number of places in the district.

A company has just been formed in Berlin with a capital stock of $105,000, to be known as Die Motorwagen Gesellschaft, to undertake the sale and letting out of motor vehicles. The new company will acquire the "Motor Kutcherei" of the Allgemeine Motorwagen Gesellschaft and will enlarge the same by the addition of a number of electrical and gasoline vehicles.

A GERMAN GASOLINE FREIGHT WAGON.

A heavy motor wagon, stated to be capable of carrying a load of 7 tons, has lately been completed by the Eisenach Fahrzeugfabrik, of Eisenach, Germany. The motor, which is operated by gasoline, is of 12 h.p. and is located in the fore part of the frame. It is fitted with water jacket and tube igni-

tion. Three forward speeds of 5, 10 and 15 kilometers per hour, as also a reverse motion of 4 kilometers, are provided, the power of the motor being transmitted by a longitudinal shaft, through bevel gearing to a countershaft at the rear and from the latter by pinions gearing with internally toothed rings bolted to the rear road wheels. The frame of the wagon is built up of steel tubing, the tubes being also made to serve for the circulation of the cylinder cooling water. The road wheels are of strong construction, being of metal with tubular steel spokes. The wagon is claimed capable of mounting 12 per cent. gradients.

THE MOTOR TRADES ASSOCIATION.

The recently formed Motor Trades Association has been registered as a joint stock company with a nominal capital of £100 in £1 shares. Object: To protect the interests of persons engaged in the motor industry, to manufacture and deal in motor cars and cycles, and (if deemed desirable) to insure against accidents caused by or to motors.

AN INTERNATIONAL AUTOMOBILE CONGRESS.

Under the auspices of the French Ministry of Commerce, Industry, Post and Telegraphs, an international congress on automobilism is to be held in Paris next year. The organization committee consists of: President, M. Michel Lévy; vice-presidents, the Count de Dion and M. G. Forestier; secretaries, the Comte de Chasselouf-Laubat and M. G. Collin. The congress opens on July 9 next and will last a week. The first meeting will be held in the large hall of the Palais des Congrès, while the club house of the A. C. F. will be the locale of the subsequent gatherings. The questions to be discussed have been divided into four groups: (1) History of automobilism; (2) technical subjects—motors, transmission, different methods of propulsion, etc.; (3) automobilism from the economic standpoint, and (4) international questions. Automobilists of any nationality are invited to take part in the congress and are invited to send in applications for membership to the secretaries, Rue de Ponthieu 51, Paris. The membership subscription is 20 frances.

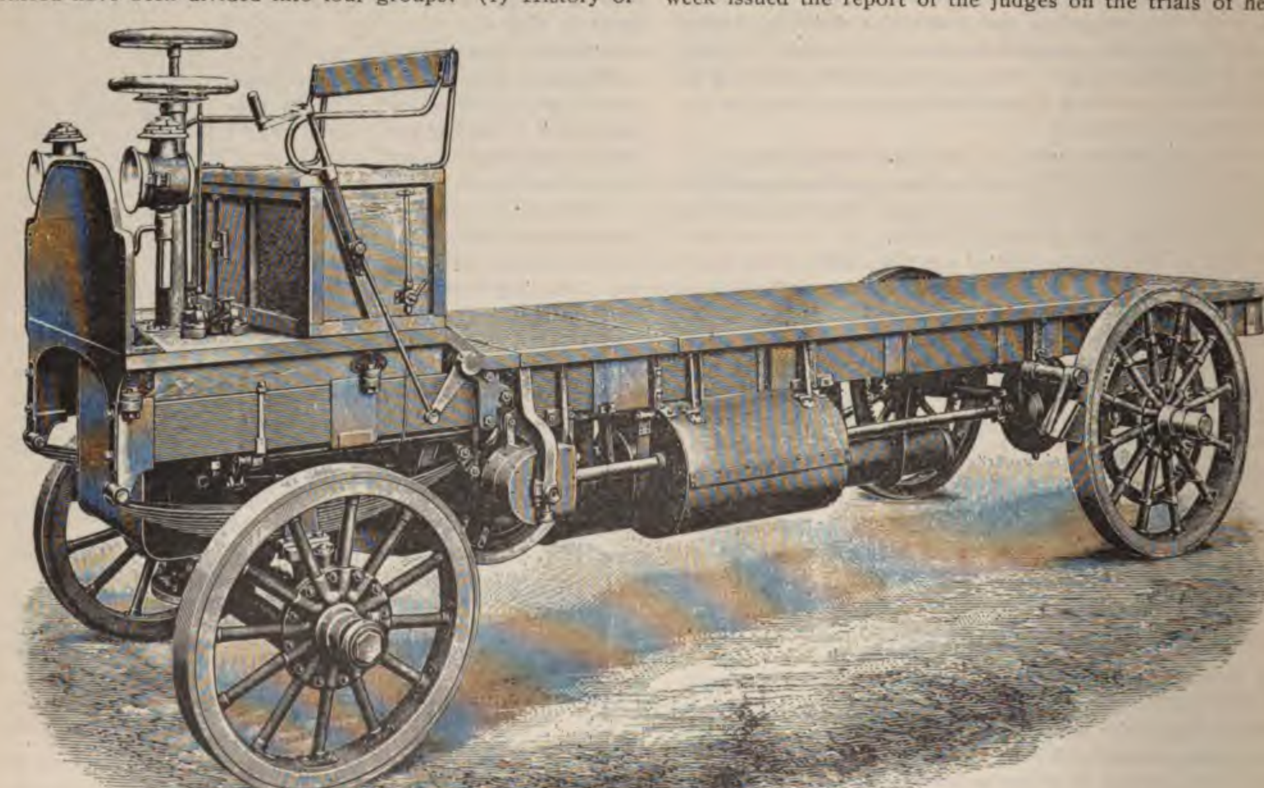
FINANCIAL RESULTS.

The reports of two motor vehicle concerns have made their appearance this week. The report of the Beeston Motor Co., Ltd., of Coventry, is made up to Aug. 31 last. "After charging against the revenue for the year the cost of all experiments and new models, there has been a trading profit of £712 14s. 6d. A fair number of motor quadricycles, designed and put upon the market at the end of last year, have been sold during the present season, but it became evident in the course of the year that the demand for that class of motor was not likely to be sustained, the great bulk of inquiries being now for a light carriage to carry two persons side by side. The company has been successful in designing a carriage to meet this demand, which has been favorably received."

The other report referred to is that of Stirling's Motor Carriage, Ltd., of Hamilton, N. B. After writing £5,000 off good will, there is a net profit on the year's working of £2,246, out of which a dividend of 5 per cent. has been declared to the stockholders.

JUDGES' REPORT OF THE 1899 HEAVY MOTOR VEHICLE TRIALS AT LIVERPOOL.

The Liverpool Self-Propelled Traffic Association has this week issued the report of the judges on the trials of heavy



THE EISENACH GASOLINE TRUCK.

motor vehicles held in July and August last. The report extends to over 130 pages and is accompanied by numerous illustrations and diagrams of the vehicles which took part in the trials. It opens with an account of the origin of the competition, followed by the conditions and general arrangements regarding the same. A very complete illustrated description of the competing vehicles occupies the next 40 pages, while the account of the trials themselves and of the results obtained occupies over 50 pages. The book ends with the "conclusions" of the judges, which are reproduced below:

General Efficiency.—The vehicles were generally superior to those submitted for trial last year and can be regarded as having arrived at such degrees of mechanical excellence and efficiency that their use in practical trade operations will be attended with success and economy as compared with horse traction.

Town Haulage.—The vehicles were suitable for trade purposes in Liverpool and neighborhood, and merit recommendation to cart and team owners, and to others requiring to transport heavy loads. The effective speed, on set pavement, should be double that of horse drawn lorries carrying equal loads, and the difficulties at present experienced in ascending or descending hills are overcome by the motor wagon.

Distance Haulage.—The vehicles were capable of competing advantageously for the transport of loads varying from 4 up to 6½ tons over distances up to 40 miles, over which distance a working day of 12 hours should suffice for collection, transport and delivery. This assumes railway rates to correspond with those in the Liverpool district.

Maintenance.—It seems necessary at present, where work is conducted over roads similar to those traversed during the trials and at speeds of from 5 to 6 miles an hour, to allow about 15 per cent. per annum on the prime cost of motor wagons of the admirable design, workmanship and material exhibited in the two to which gold medals were awarded. The allowance may rise to 30 per cent. for vehicles the construction of which has not been carried out in the same adequate manner. Many sources of temporary breakdown which gave considerable trouble during the 1898 trials have been removed, and the uncertainty of service consequent on these referred to in the first report has been decreased. The judges suggest still better and more thorough attention to lock nuts, collars, split pins and the effective keying of wheels, all of which, in view of continued service, are well worthy of a certain expenditure of time and money. Such expenditure might prevent the breakdowns which at present are more likely to occur in self-propelled vehicles running on common roads than under other mechanical conditions. The vehicles which competed could be relied on for regular working subject to periodic examination, maintenance in thorough working order, and to small improvements in the details above remarked upon. This is, of course, only adopting the recognized principles of all locomotive practice. The imperfections of common roads are the principal causes of the heavy depreciation and maintenance charges and of whatever element of uncertainty remains attached to any service of motor vehicles.

Control.—The general control, starting, steering and stopping of the vehicles when working on the road and among traffic, was superior to the best types of horse drawn vehicles.

Manœuvring.—The facility with which motor vehicles reverse is of considerable importance, and in this respect the competing vehicles proved to be quite satisfactory. They were able to work into and out of an embayment of one and a half times their own length and draw up close to and parallel with the wall of the bay, but this particular manœuvre proved, in the case of some of the vehicles, slightly more tedious in its performance than with horse drawn vehicles. They are capable of going anywhere that horse vehicles are ordinarily required to go.

Hill Climbing.—The tests at Everton demonstrated that the hill climbing powers of the vehicles, including stopping and starting on a grade of 1 in 9 (up and down), were greatly superior to those of horse drawn vehicles.

Weight Distribution for Adhesion.—The importance of placing as much as possible of the weight of the vehicle upon the driving axle cannot be magnified, and is seriously commended to the immediate attention of manufacturers. No vehicle has yet come before the judges which would not under some conditions have been more efficient had more adhesion been available. The greater propulsive effort which the engines were in all cases capable of providing could not be effectively applied, in several instances, because the distribution of weight, when the wagon was light or when it was laden, and sometimes in both cases, was not sufficiently concentrated upon the driving wheels.

Operating Gear.—The number of operations requiring attention from the drivers were generally less than last year, and there were more satisfactory arrangements of an automatic nature for regulating and controlling the vehicles. All taps, levers, valves, etc., should be either in front or to one side of, and not behind, the driver, and should be simplified and disposed for convenient manipulation. It is satisfactory to note that several of the vehicles were so well designed and arranged as to admit of an unskilled driver being intrusted with their management.

Steering.—It is highly important to have absolute control of steering by means of a wheel and gear, and to have no play or slackness in the connections. Although direct tiller steering is inadvisable for heavy motor traffic, the judges had occasion to observe that, on the other hand, evils might arise from the action of a wheel steering gear if it were too slow. Such gear should therefore be as rapid in action as is consistent with reasonable physical exertion on the part of the driver.

Gearing and Transmission.—Both chain and tooth transmission were employed, and each has special advantages. It is undesirable to pronounce in favor of either system. Duplicate gear wheels should be carried by all motor vehicles for heavy loads which use tooth transmission. The conclusion arrived at in the first report, that "at least two speed gears, or an equivalent reserve of power, are essential to successful working," received ample confirmation.

Fuel.—Solid fuel, particularly coke, is at present more economical, liquid fuel being at a serious disadvantage where costs per net ton mile are a determining factor. Some better means should be adopted to prevent or intercept the particles of dust and soot which up to the present cause considerable nuisance, particularly when the boiler is steaming hard.

Condensers.—Where water is easily obtainable at points not more than 15 miles apart, it is questionable if a condenser is of any advantage unless its efficiency is very high. It is to be noted that three of the vehicles using condensers did not lubricate their cylinders, and this might prove a source of excessive wear in the cylinders. Probably the introduction of effective filtration or graphite lubrication will meet this objection. Filtration cannot, apparently, with motor vehicles, be yet relied upon as effective in preventing lubricants passing into the boiler.

Speed.—Five miles an hour, as permitted by law, seems at present a suitable limit for very heavy traffic, since at higher speeds deterioration of the framework and wheels through vibration and shock rapidly occurs. If new inventions permit of higher speeds being attained without injury to the vehicle, or risk of endangering the safety of the public, the possibilities in the development of motor traffic for cheap, regular and fast transport of goods appear to have scarcely any limit.

Future Competitions.—In any future competition it is advisable to stipulate (a) that no vehicle carrying less than 4 tons of freight be allowed to take part; (b) that the boiler, tanks, and oil baths shall be fitted with drain plugs at their lowest points; (c) that the cross section of any pipe connecting two tanks shall be not less than that of the pipe provided for filling the first tank of the two; (d) that provision be made to lock the compensating gear.

Performance.—Four tons of load, carried on the legal tare of 3 tons at the legal speed of 5 miles an hour, is the maximum performance that has so far been obtained satisfactorily by a four-wheeled vehicle, but a load of 7 tons can be carried if a single trailer be used.

Wheels.—The wheels and tires were generally efficient, but concentration of heavy loads upon the present small area of wheel contact is a serious difficulty in the problem of goods transport by motor vehicles, and constitutes probably the chief mechanical cause of the slow progress made.

Legal Restrictions.—The difficulties imposed by meeting the limit of 3 tons tare under the Locomotives on Highways Act, 1896, were again serious drawbacks to ideal construction. The strength of frames and working parts, the area of bearing surfaces, the width of wheel tires, the available platform area, the stoutness of the platforms and wood work generally, and the diameters of axles and shafts were consequently reduced below what is compatible with a satisfactory life in commercial work. The judges are unanimously of opinion that the raising of the limit of tare to 4 tons is eminently desirable in the interests of proper economy and efficiency, and they are further of opinion that such an increase in the tare weight is for the safety of the public and in their interests.

Commercial Requirements.—The judges hold strong views that the requirements of trade in large manufacturing and distributing centers cannot be met with the load limit of 4 tons, which these and the previous trials clearly indicate as the working maximum. To satisfy such requirements fully it is necessary to carry from 6 to 10 tons on one platform. It is clear to them that the heavy motor wagon industry cannot in this country attain its legitimate proportions until the present restrictions are modified so as to enable manufacturers to supply vehicles capable of carrying loads of the same weight and bulk as those now drawn by horses. Self-contained vehicles capable of transporting regularly loads of from 6 to 8 tons at from 4 to 5 miles an hour, and up to 10 or 12 tons at reduced speeds, would shortly be available were a 4-ton tare sanctioned.

A society called the Compagnia Technico-Industriale per Automobili has been organized at Rome, Italy, to promote the motor vehicle. The plans of the society include a permanent exposition of automobiles, a club for the encouragement of the industry, an emporium and livery and a technical bureau. The society, which is located at 17-20 Piazza S. Marco, solicit catalogues and other information from American manufacturers.

Simpson & Bodman, Cornbrook, Manchester, England, are about to commence the erection of works for an increased output of steam vehicles, their generator and engine, recently described in our columns, having been shown to be particularly adapted to vehicle use in rough country.

A company has just been formed at Folkestone, a well-known South Coast seaside resort, to be known as the Folkestone & District Motor Co., Ltd., to start a public service of motor vehicles.

It is reported from Brussels that negotiations are in hand for the starting of a service of automobiles in the Congo similar to that recently organized in the French Soudan.

The Lanchester Engine Co. has just been registered with a capital of $500,000 to acquire certain inventions of Frederick W. Lanchester, of Birmingham, relating to gas and oil motor or other engines for vehicles and other purposes.

MINOR MENTION.

The Pan-American Improvement & Commercial Co., of Chicago, Ill., has been changed to the Fischer Moto-Vehicle Co.

H. H. Thorpe is said to be interested in a company which is being organized to manufacture automobiles at Minneapolis, Minn.

The Washington (D. C.) Electric Vehicle Co., incorporated last May with $6,000,000 capital stock, has decreased its stock to $1,250,000.

Lieut.-Col. L. F. Pinault, Deputy Minister of Militia and Defense, of Canada, is searching for motor transports for South African service.

The St. Louis Gasoline Motor Co., St. Louis, Mo., is in the hands of the law on five attachments taken out by former employees holding claims for wages. The officers of the company were said to be out of the city.

Edward L. Strong, Cleveland, O., writes that he is meeting with good success in organizing Cleveland automobilists into a club. Some 30 members were enrolled at the first formal meeting on Monday of this week.

The American Roller Bearing Co., Boston, Mass., have just contracted with the New York Electric Vehicle Transportation Co. to fit the wheels of all their cabs now in operation with "A. R. B." roller bearings.

The former employees of the Consolidated Street Car Co., of Cleveland, O., who went on strike last summer, have constructed a gasoline omnibus seating 30 persons and propelled by a 30 h.p. motor. It is now undergoing tests.

It is announced that the control of the General Carriage Co., holding the Livingston franchise to operate motor cabs and omnibuses in all the large cities of New York State, has passed into new hands. Among the new directors are Cyrus Field, Judson and Joseph Leiter. They promise a new motive power.

The automobile parade which took place on New Year's day at Cleveland, O., was attended with weather conditions far from favorable, a blinding snow storm accompanied by a high wind. Notwithstanding the discomforts quite a number of vehicles were in line and a crowd of several thousand gathered to witness the demonstration.

The Dodge Machine Screw Co., Boston, Mass., have moved into larger quarters and put in special machinery for turning out all kinds of small metal motor vehicle parts, such as tool steel bearings, special screws, nuts, studs, bolts, pins, etc. They are prepared to furnish estimates on any work of this kind. Their new address is 154 Purchase St.

COMMUNICATIONS.

Wanted—Motor Buses.

Chattanooga, Tenn., Jan. 3.

Horseless Age:

writer, representing a party of summer residents of n's Ridge (a Chattanooga suburb), is in the market for o bus capable of accommodating 15 passengers. The ıtive prospectus of what is desired is attached.

are prepared, and are anxious to contract immediately, vite bids and investigation.

associates in the proposed purchase are Franz Garden-. T. Dewees, B. F. Fritts, T. W. Fritts, W. E. Raht, Griffiss, L. Gerstle, H. S. Probasco,, Chas. Herron, J. n Deman, D. M. Steward, J. F. Johnston and Robt. son, all of Chattanooga.

o the responsibility of the parties interested, we refer bank or banker in Chattanooga or to any of the mer-agencies. Very truly yours,

MILTON B. OCHS.

SPECIFICATIONS.

ıcity.—A vehicle that will accommodate 15 passengers addition from 500 to 750 lbs. of baggage.

earance.—We desire to avoid expense in creating ap-ce, avoiding extra finish of cab and extra qualtiy of tering. Simply want a comfortable vehicle, unpreten-n appearance but to be depended on for work and lity.

ive Power.—We think gasoline the most practical for rpose, considering that main part of trip is in country electricity is not available.

ance to Be Covered.—From Chattanooga to Walden's —14 miles—to which may be added 6 miles to cover s residences off the main roadway. In leaving the city ing the vehicle would be subjected to a round trip cov-o miles, one-half of which would be made in the even-d the remaining half the following morning.

acter of Roadway, Grade, Etc.—From 2 to 3 miles of streets, ¾ mile of bridge laid with timber, 3 miles of e country road, 5 miles of mountain. This mountain at all times in good repair, some portions, however, sloppy and heavy following heavy rains. The average of the road is 6 per cent., but some portions (possibly in all) reach a grade of 10 per cent. The road on top ıntain should be given particular attention, as a large the surface is of sand, reaching in some places a depth n 2 to 3 in. Only one stream of water is crossed, be-branch 8 to 10 ft. wide and about an average depth of The bed of this stream is about on a level with the nd approaches could be readily and inexpensively con-d.

.—We want price on machine delivered in Chattanooga for work and accompanied by an expert who will op-or three or more trips.

antee.—Manufacturers to demonstrate the practicabil-the vehicle for the work and to guarantee for at least ar against failure of any working parts by ordinary use.

gestion.—Before construction it would be well for de-to personally investigate the roadway, and for our satisfaction we would agree to meet the expense of nvestigation.

Balanced Torque Reaction.

Reading Pa., Jan. 6.

Editor Horseless Age:

I wish to congratulate The Horseless Age on the success of its endeavors to publish correct information on the subject of balancing. There are few branches of engine design on which popular misconception is more rife, but I think it will be impossible henceforth for such absurdities as the one which called forth my first letter to find their way into your columns. I wonder, by the way, if the reason that we are not hearing anything further about Mr. A. M. Herring's balanced flying machine motor, described in your issue of June 7 last, is not precisely that mentioned at the foot of page 12 of my article (see Explosion Motor Number), as requiring that all the power be delivered from the secondary shaft. As Mr. Herring has lately said that it is impracticable to balance the torque reaction, owing to the "noise and shock of the gears" due to backlash, it seems not improbable that he came to grief through trying to do too much. Theoretically that flying machine motor is in perfect balance. Practically the secondary shaft will outrun the crank shaft on every compression stroke, and if the gears are much worn there may be a lively shock when their working faces come together again.

In the matter of balanced torque reaction, the vehicle motor has an important and almost unworked field before it, and I have no doubt myself that some revolutionary advances are destined to be made therein. Sincerely yours,

HERBERT L. TOWLE.

Motor Vehicle Accident Insurance.

Boston, Jan. 6.

Editor Horseless Age:

I have noticed in your paper from time to time discussions of the liability of owners and drivers of horseless vehicles in case of accidents caused by frightened horses. It seems strange to me that no mention has been made of the fact that there are companies that insure one against all liability in case of accidents of this kind. The company takes the entire responsibility of conducting the case, and, if damages are awarded, pays them without one cent of expense to the holder of the policy aside from the premium. I have a policy of this kind and recently caused an accident by frightening a horse that I feel sure would have cost me at least twice what the policy did in case I had had to defend myself in court, although I do not think, nor do the accident company, that I was in any way to blame.

The policy of the company is to fight a case of this kind rather than settle out of court, in order to strengthen the precedent.

HAROLD H. BROWN.

A few years ago Barnum & Bailey exhibited one of the Duryea carriages in their street parades and in the circus ring. Now it is announced that a Western circus manager is figuring with the Duryea Mfg. Co., of Peoria, Ill., with the purpose of equipping all their wagons and animal cages with motors. Circuses will no doubt ere long be exhibiting horses as curiosities.

OUR FOREIGN EXCHANGES.

Traffic Regulation and the Speed of Motor Vehicles on Highways.

(Continued from last issue.)

Mr. Mann thought Mr. Crompton's suggestions as to cycles being permitted to use footpaths where roads were unfrequented and bad excellent, and cited the French practice in support. In comparing the cost of the electric trolley and petroleum car carriage, he fancied Mr. Crompton had overestimated the cost of one and underestimated the other. Touching upon heavy traffic regulation, Mr. Mann cited the oft-quoted example of Manchester, where lorries were not allowed in the main streets before 6 o'clock at night. He thought with regard to traffic regulation that it would be a good plan to have the roadway divided longitudinally by marks, so that the tracks for heavy and light traffic, or for mixed traffic with overtaking space, were clearly defined. The existence of such lines would largely simplify questions of damage arising out of collisions, etc., and would avoid the confusion of evidence which occurs when such cases come up for decision.

Mr. Staplee Firth was anxious that, now the traffic and speed questions had been so ably ventilated, the ideas and opinions expressed as to both should be allowed to percolate into the proper channels. Mr. Firth then referred to slack driving of wagoners and teamsters of all sorts on country roads, and proceeded to cite the many admirable provisions of the statute of William. IV., which gave automobilists and others such clear protection on the highway. By one section, the surveyor guilty of leaving heaps of mud, etc., by the side of the road was personally liable to a fine of £5, while any one who obstructed the road willfully by placing anything thereon could be taken in charge by the person obstructed and charged at the nearest police court before two magistrates. He cited the case of the High Wycombe constable who, to stop a motor car, placed a baulk of timber across the road, and said that this very officer could have been taken in charge by the automobilist and charged at his own police station. The same procedure can be followed with regard to persons jeering or using bad language upon the highway. This act also lays down clearly the necessity for a man to lead horses in tandem or triplet, which are uncontrolled by reins to the driver. The British public were at present in somewhat the same position to the autocar as they were to Stephenson's locomotive in its early days. Having reviewed the conditions of speed, Mr. Firth said that after listening to Mr. Crompton's paper he considered they should not carp at the allotted 12 miles per hour. They were fairly well off as they were. The present difficulty lay with the rural policeman, whose word was always taken for granted. If they could induce the authorities to deal with the real evil, which was after all the common traffic, they would have done well.

Mr. Shrapnell Smith considered that the most important feature in the traffic regulations related to the pulling up of omnibuses and heavy traffic on the near side. He thought they should and ought to have fixed stopping places. These were found convenient in Liverpool. With regard to lorries, he would draw attention to the Liverpool practice of hovels or docks in the buildings of warehouses, which allowed the horses and van to be backed in right under cover, and out of the way of the traffic. Vans were not allowed to stand at the roadside, so there was no obstruction to traffic. In his opinion the question of speed was of the very highest importance, for with self propelled vehicles, vehicles of high capital charge were being dealt with, and the cost of demurrage chargeable against same became so serious an item as to largely reduce the advantage of the use of motor vans, etc. Therefore it was particularly essential to get the most speed out of these vehicles. On the dock roads, 8 miles in length, it was found that by a sort of tacit agreement the traffic sorted itself into heavy and light lines of traffic. He thought, too, that furious driving was merely a relative matter. In the disorganization caused by traffic suddenly pulling out, he thought from his experience with motor wagons fitted with cabs and other vehicles, in which the driver could not see to the rear or either flank, that a mirror ought to be fitted to the dashboard in such a way that the driver could see what was to his rear on his off side. Runs on motor cars had done much for the conversion of the Liverpool authorities. Tramways appeared to him to be a confession of bad roads, and the authorities of many provincial cities were beginning to perceive that tramways would not pay them, and that their salvation was in motor cars.

Mr. Edmunds cited the case of Newcastle, where the question of taking over the tramways had been in consideration for so great a length of time, that some enterprising people had started a motor car service, and with fares at the rate of 1 penny per mile the cars had been earning as much as £19 per week, with the result that it was a question whether a motor system should not be established in lieu of electric traction.

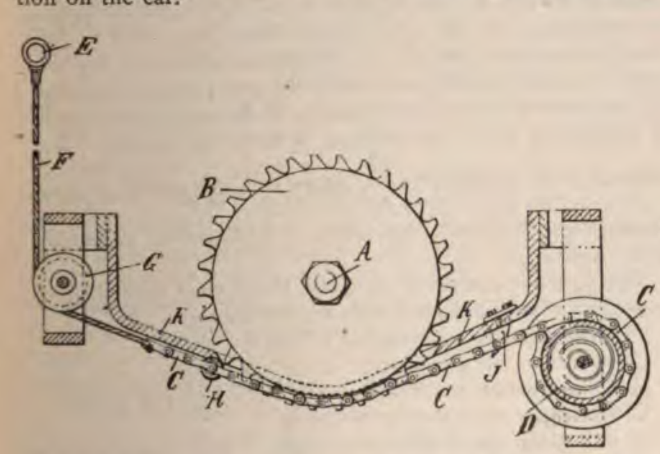
Mr. Calthorp thought the question of speed was a matter of education. What was high speed for one generation was low speed for another. On the Continent and in the United States speeds of traffic were very much in excess of ours. When the speed of the electric trams was first discussed in Syracuse, U. S. A., it was suggested that the high speed proposed would result in the loss of a few citizens, but it was considered that the saving in time to the rest of the community would balance the loss of the few citizens. So the high speed was adopted, but, happily, up to date there had been no loss.

Mr. Lyons Sampson having also spoken, Mr. Crompton briefly replied. He considered the discussion much better than his paper deserved, and so thorough that little was left to deal with. He was delighted with Mr. Weaver's speech, as he was a good specimen of a road surveyor, a cyclist, and a man who had taken out a patent for an exhaust box for horses. The question of the superiority of steered road traffic to transport infinitely more material than by line or train he had reported on years ago to the Indian Government. He thought it might be easy to persuade county councils to allow cyclists to ride on footpaths where roads were bad. In view of Mr. S. Smith's remarks as to delays and cost thereof, the manner in which gold was poured out by reason of the delays to traffic which occurred hourly in the London streets was not fractionally appreciated. It caused an immense loss. With regard to speed the fact was, what was fast to one man was slow to another. The public had to be educated to speed, and would be educated in time. The trouble was that the popular estimate of speed was drawn from the horse, and as 13 miles an hour was considered dangerous from an equine point of view, so that was considered dangerous to the public. His object in writing his paper was purely suggestive. If it had the effect of provoking other and more closely considered essays, he should be satisfied. They could do much in quietly educating the public that increased speed is perfectly safe.

A Motor Starting Device.

One of the preliminary operations in starting an oil motor is the rotation of the shaft by hand until a firing charge is obtained. Usually this operation is effected by means of a cranked handle; it, however, involves considerable muscular exertion, especially when the motor consists of two cylinders. At all times it is inconvenient, and nothing more detracts from the tout ensemble of a motor vehicle than the spectacle of the driver having to go through this "winding up" process. It would, of course, be an easy matter to provide a small air motor for this purpose, but in these matters we follow rather too slavishly Continental practice; and as our Continental friends are content to employ a simple handle, all or nearly all British motors are fitted with the same primitive thing.

A step toward improvement has been made by Mr. E. Estcourt, M.A.C., a well-known automobilist, who has introduced a device which should, we think, commend itself to automobilists, if for no other reason than that it renders it unnecessary for the driver to descend from his seat in order to give the preliminary turn to the motor. The device in question, as will be seen from the accompanying figure, is very simple. A wheel with serrated teeth is keyed to the motor shaft. On a drum, within which is a coiled spring, is wound a few turns of plate chain, the free end of which is led to a handle; by pulling this latter the chain is extended and made to engage with the toothed wheel; this operation uncoils the spring. On freeing the handle the spring coils itself up, and in so doing winds up the chain, which causes the wheel and the motor shaft to rotate. Referring to the drawing, A is the motor shaft, B the toothed wheel keyed to it, and C is the chain gearing with the wheel B. One end of the chain C is fastened to a spring drum, D, the tendency of which is to keep the chain wound up on the drum, and the other end of the chain is secured to a handle, E, placed in any convenient position on the car.



The chain C is provided with a projection, H, preferably in the form of an elongated link-connecting roller, as shown, which projection, when the spring D is acting to wind up the chain will abut against a fixed stop, J, and thus present the drum from taking up any more of the chain. K is a fixed slotted plate serving as a guide for the chain, and to this plate K the stop J may conveniently be secured.

A pull on the handle E will draw up the slack of the chain C and bring it into gear with the wheel B, and a further pull will cause the chain to rotate the wheel, thereby rotating the driving shaft A of the motor.

It will be gathered that, in this mechanism, there is no mechanical advantage, and the same amount of muscular effort has to be exerted as with an ordinary handle. Its great merit is, as we have said, its convenience, as it enables the driver to give a few preliminary turns from the seat. We understand this gear has been fitted to a motor vehicle, and has fully answered its purpose.—Automotor.

The description states that freeing the handle, etc., causes the wheel and motor shaft to rotate. From the shape of the wheel, teeth, etc., we judge that this statement is a slip of the pen and that the later paragraphs more nearly describe the action of this simple and doubtless efficient device.

R. I. C.

The Abeille Carbureter.

The Abeille motor is provided with a carbureter no less remarkable in point of view of rugged simplicity.

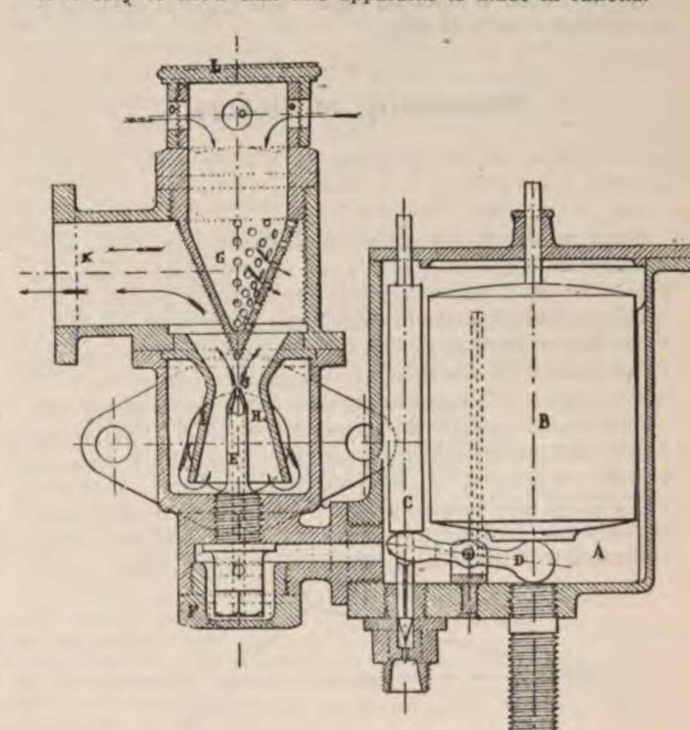
The carbureter is of the constant level pulverizing type. The receiver A contains a float, B, acting by means of the beam b on a rod, C, which permits the entrance of oil, to maintain the supply, through the pipe E.

Air enters by the tube H, through the lower part of the converging passage I, the throttled portion corresponding to the end of the pipe E, and carries with it the requisite quantity of oil previously regulated by the size of the opening J.

The mixture of air and oil vapor thus obtained is thrown on the separating cone G, pierced with a great number of small holes permitting the necessary supply of fresh air for the treatment of the gas.

To this end the hollow cone G is surmounted by a movable cap, L, provided with four openings, O, which are opened or closed by the rotation of the cap aforesaid. The mixture thus regulated is delivered to the motor by the tube K.

It is easy to show that this apparatus is made in rational



THE ABEILLE CARBURETER.

fashion and that the number of the parts is reduced to a minimum. To adjust or cleanse the small opening J is possible without interference with the piping or taking down the apparatus. It suffices to unscrew the plug F to withdraw the pipe E by the lower part.

To empty the carbureter after a long stop it is equally convenient to unscrew the plug F.—Gaston Sencier in La Locomotion Automobile.

The Bayley Steam Lorry.

At the steam vehicle trials, both at Richmond and Liverpool, we experienced some difficulty in obtaining particulars of this vehicle, about which some rather extravagant claims were advanced. The following description relates to the motor van that Messrs. Bayleys, Ltd., have tendered for to the Chelsea Vestry: The frame is of channel steel, and supported on the axletrees through ordinary wagon plate springs. The dimensions of the vehicle are: Length, 14 ft. 2 in.; breadth, 6 ft. 6 in.; height, 8 ft. 5 in. The wheel base is 8 ft. 6 in., and the wheel gauges 5 ft. 8 in. and 5 ft. 10 in.. The driving wheels are of wood with steel stocks and dished tires, and are 3 ft. diameter; tire, 5 in. wide; leading wheels, 2 ft. 9 in. diameter; tire, 4 in. wide. The motor is a vertical compound, the cylinders being 4 in. + 6½ in. diameter × 5½-in. stroke; revolutions per minute, 500. The power is transmitted by means of bevel and spur gearing to internally toothed wheels bolted to the driving wheels. There are two speeds, the velocity ratios between the motor and driving wheels being 10.1 and 17.7. The generator is of the modified De Dion type, having 70 sq. ft. of heating surface and carrying steam up to 250 lbs. per square inch. The fuel is coke, and the consumption is about 7 lbs. per mile. The weight is about 3¾ tons in working order, and a load of about 3½ to 4 tons can be carried at a speed of about 6 miles per hour. The price, as tendered to the Chelsea Vestry, is £650.

Balancing of Motors.

By H. E. Wimperis, Wh. Sc.

III.

A simple way of looking at the problem of balancing is to consider the engine as a whole and to so proportion its parts that when the engine is working the center of gravity of the whole machine remains in exactly the same position relative to the rest of the car. If this were attained then there would be absolutely no vibration or shaking whatever. The difficulties that stand in one's way in attempting to satisfy this condition are several, the most important of them being, firstly, that owing to lack of space the connecting rod has to be made short, and secondly, the surging action due to the swinging of the connecting rod. In fact, most of one's troubles are due to the connecting rod. If this rod were long, compared with the radius of the crank pin path, then the balancing difficulties in regard to it could be overcome even for two cylinders only, working side by side. In any case they could be got over if the engines worked end to end.

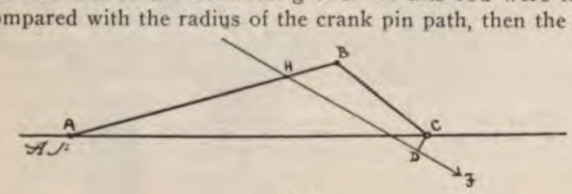


FIG. 5.

In respect to the second point, the difficulty in balancing arises from the fact that the line of action of the acceleration force acting on the connecting rod does not pass through the center of the crank shaft, but lies outside it, and so causes a fluctuating turning moment in addition to the reciprocating forces. Thus, in Fig. 5, if AC produced be the center line of the engine, and A the crosshead, AB the connecting rod, BC the crank, C the center of the crank shaft, HF the line of action of the acceleration force of connecting rod and passing through H, then drop a perpendicular CD on to FH and we see that the surging moment is F × CD, whereas if HF had passed through C there would be no such moment at all.

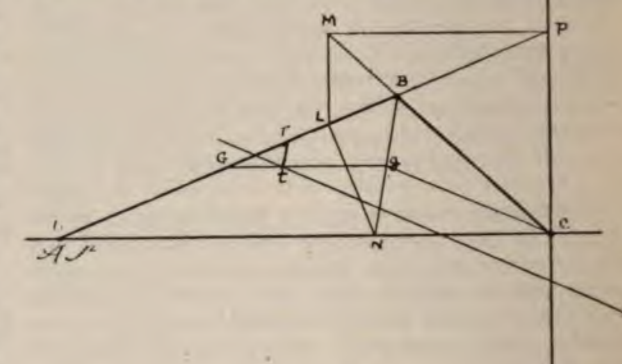


FIG. 6.

The way to find out which is the line of action of this force is shown graphically in Fig. 6. Here ABC is connecting rod and crank as before, AB is produced to P, meeting the vertical through C in P, PM is parallel to AC, meeting CB produced in M, ML is perpendicular to AC, LN is perpendicular to connecting rod AB, join BN and draw Gg parallel to AC, join Cg and mark off GT in accordance with what follows, draw Tt parallel to BN, and finally through t draw tF parallel to Cg, then tF is the line of action of the acceleration force of connecting rod. The point T is found by marking off a distance from G equal to $\frac{k^2}{AG}$, where k is the radius of gyration of the rod about G and where G is the center of gravity of the rod.

This figure is somewhat complex, but it gives several other important results besides the above; for instance:

CN measures the acceleration of the crosshead.
CB measures the acceleration of the crank pin.
Cg measures the acceleration of center of gravity of rod.
CP measures the velocity of piston.

It was stated above that one condition that would tend to make the balance more perfect was that tF should pass through C; the condition that this should be the case is that $k^2 = AG \cdot GB$. In an engine measured by the writer, AG was 37.3 in., GB was 22.7 in., and $k^2 = 580$; in this case $AG \cdot GB = 850$, which is greater than k^2, so that the surging action of the connecting rod was very apparent. Several ways of making this equation hold have been suggested, such as producing the connecting rod beyond the big end, or spreading the mass of the connecting rod out laterally.

However, when this condition does hold, then the action of the connecting rod may be exactly replaced by considering

part of the rod condensed at A and the other part at B in the ratio $\frac{GB}{AG}$. The problem of balancing is then simple, the part condensed at A is considered to be added to the weight of piston, piston rod, and crosshead, and the part at B can be considered as part of the crank. Then, as the crank is a simply rotating piece it can be exactly balanced by a counterweight, and the crosshead masses, being reciprocating, can be balanced by other reciprocating masses going in an opposite direction, such as the corresponding pieces of another cylinder, or if there be only one, by another rotating balance weight, and so leave only the vertical forces unbalanced.

Really the difficulties in balancing are only structural, since if two cylinders working on opposite sides of the crank shaft, as in Fig. 7, were able to be made in line, perfect balancing would be attained, provided the connecting rods were as above.

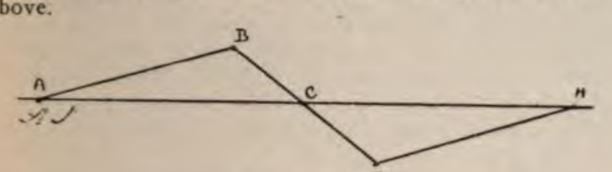


FIG. 7.

It naturally follows from the preceding that some method of finding whether the equation $k^2 = AG \cdot GB$ holds or not would be useful.*

Put $AG = l_1$ and $GB = l_2$, then it is very easy to find the values of l_1 and l_2, since it is only necessary to balance the rod horizontally, and the point of support being the center of gravity, the lengths l_1 and l_2 can be measured. Finding k^2 is a little more trouble, but the easiest method (or at least the easiest experimental method) is to suspend the connecting rod by a slackly fitting pin through the small end and see that the rod swings freely for a dozen swings or so. Then take the average time that the rod takes to swing from one side to the other and back again and call that time τ; then it is easy to prove that—

$$k^2 = l_1 \left(\frac{g\tau^2}{4\pi^2} - l_1 \right).$$

or, if $\frac{g}{4\pi^2}$ be taken to be 0.8,

$$k^2 = \tfrac{4}{5} l_1 \tau^2 - l_1^2.$$

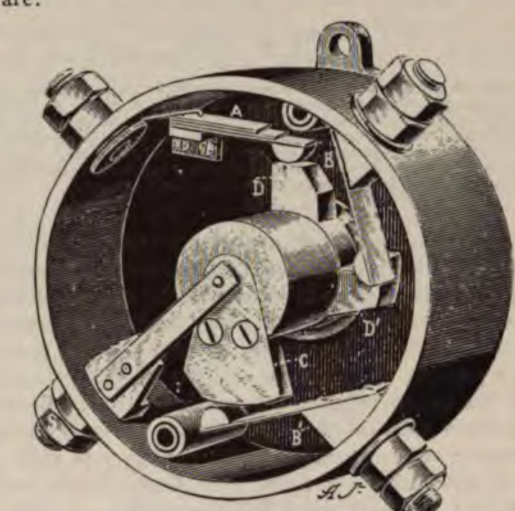
In this fashion k^2 and $l_1 l_2$ can be compared. In Fig. 7 it will be noted that the cylinders are taken to be on opposite sides of the crank shaft, and when this is the case it is possible to arrange things so that the obliquity of the connecting rod may be neglected. When, however, there is only one cylinder, or when both work side by side, there is a small vibration induced which grows greater the shorter the connecting rod is made.

Messrs. Robinson and Sankey have pointed out that a perfect balance is attained in a six-line engine, but automobilists have to be content with less ideal conditions. It is evident that a rotary engine such as the Parsons' turbine is easily balanced, and one rather anticipates that it is the engine of the future.—The Automotor.

* Note that this condition holds when the connecting rod swings in equal times whether suspended from the big end or the small end; this is a simple test.

The Bolide Current Distributer.

The Bolide carriage, who has held the kilometer record since last May for petroleum motor vehicles, has just been provided by its maker, Mr. Leon Lefebvre, with an electric current distributer, which appears to present several appreciable advantages. The cranks of the motor are 180 deg. apart, therefore the respective times of the action of the two cylinders are:



Cylinder A.	Cylinder B.
1. Suction.	1. Expulsion.
2. Compression.	2. Suction.
3. Working stroke.	3. Compression.
4. Expulsion.	4. Working stroke.

The result of this is, as in all cylinders where the cranks are thus placed, that the two explosions are produced during half the revolution of the secondary or intermediate shaft—i. e., during one-fourth of the revolution of the primary or motor shaft. If, therefore, the pinion controlling the lighting is fixed direct on the motor shaft, the two poles which determine the lighting in each of the cylinders must be always together in the same quarter of the circumference that they describe around this shaft. These preliminary lines explain why, in the Bolide distributer, of which we give an illustration, the two cams D and D' are at right angles. These two cams, in turning, alternately come in contact with the plate spring A, which receives the primary current through the terminal P. The primary current is thus opened and closed twice. Thus two induction or secondary currents are produced which reach the terminal S one after the other, being produced by a single coil.

These two induction currents are distributed, one to the ignition tube of cylinder A, the other to the ignition tube of cylinder B, also with a certain intervening space of time. (See small sketch above, in which the contact is made in A the third time, and in B the fourth time.)

For this purpose the shaft of the distributer, in addition to the cams, D and D', is furnished with a cam, C, separated from them by an ebonite washer, sufficiently thick to prevent the sparks from jumping from one end to the other. This cam remains constantly in contact with a flat conducting spring, which transmits to it the secondary current which comes from the terminal S. In its revolution it alternately touches the plate springs B and B', which are in circuit to each of the ignition tubes.

To resume, the distribution of current is made by two cams and a single spring for the primary current, and two plate springs and a single cam for the secondary circuit. As can readily be seen, this arrangement presents the advantage of only requiring one coil to effect the ignition in two cylinders (the motor running at 700 revolutions per minute).—The Automotor.

High Pressure Gas Accumulators for Automobiles.*

(A DREAM.)

By E. K. S.

*The idea of working with an oxygen-hydrogen accumulator under very great pressure was suggested to the writer by an Italian friend, Signor A. Monticolo, so long ago as 1896. The writer is well aware that the proposals made are open to almost unlimited criticism, but he hopes that the article may help towards a new line of thought and experiment in connection with accumulators. It is becoming more and more evident every day that accumulator makers have got about as far as it is possible in the development of the ordinary lead plate cell.

It is well known that an ordinary voltameter will act as a feeble accumulator cell when the electrodes are surrounded by the constituent gases of water and the proper outside connections are made. There is every reason to suppose that the action would be immensely intensified if the gases were under a pressure of, say, 3,000 or 4,500 lbs. per square inch.

(A) The energy required for ordinary chemical decomposition is about 3,829 calories per kilogram of water, the calorie being taken as the quantity of heat necessary to raise 1 kilogram of water from 0 deg. to 1 deg. Cent. It can further be shown that 1 calorie = 425 kilogrammeters or 3,081 foot-pounds. Therefore, 3,829 calories per kilogram, or 2.204 lbs. of water is equivalent to $\frac{3{,}829 \times 3{,}081}{2.2} = 5{,}350{,}000$ foot-pounds per pound of water.

(B) Now, the energy inclosed in a kilogram of hydrogen and oxygen compressed to 300 atmospheres, or 4,500 lbs., is about 108,000 kilogrammeters, or 254 calories. This is the energy due to the compression of the gases alone, and not considering that which may be furnished by chemical combination. Expressed in English units, it means that 1 kilogrammeter = 2.204 × 3.28 = 7.25 foot-pounds, and 108,000 kilogrammeters would therefore be 785,000 foot-pounds, or working backwards, $\frac{785{,}000}{3{,}081} = 254$ calories.

(C) The energy due to the state of compression of the gas is, perhaps, not so great as might be expected, but the energy provided by the combination of hydrogen and oxygen would be very considerable. Moreover, it is also highly probable that the combination of hydrogen and oxygen would be greatly facilitated by the high pressure of the gases because:

First—The gases would more easily occlude into the electrodes.

Second—The solubility of the two gases would be considerably increased, and this would facilitate their recombination through the water with development of electric current.

(D) At a pressure of 300 atmospheres, or 4,500 lbs., 1 kilogram of hydrogen and oxygen gas would occupy a volume of 6 liters, and could furnish 3,829 calories, or—

$$\frac{3{,}829 \times 3{,}081}{33{,}000 \times 60} = 6 \text{ H.P. continued for one hour.}$$

1 litre = 1.759 English pints.

1 English pint = 35 cubic inches.

6 litres = 6 × 1.759 × 35 = 369 cubic inches.

That is to say, a cell in which the space for the gases was 369 cu. in., or, say, 7¼ in. cube, would, theoretically speaking, furnish 6 h.p. for one hour. What it would be in practice the writer does not pretend to say. Perhaps some reader will try the experiment.

(E) The occlusion of hydrogen gas by the platinum electrode of a voltameter is a well-known phenomenon, and we may thus expect to still further reduce the size of our high-pressure cell by employing a cathode made of some metal which occludes hydrogen gas very readily.

The following are approximately the absorptive values of various metals in the spongy state at normal temperature and pressure, and it is at once seen that palladium has this property to a most remarkable degree:

Palladium (black)	500	volumes.
Platinum sponge	49	volumes.
Gold	46	volumes.
Iron	19	volumes.
Nickel	17.5	volumes.
Copper	4.5	volumes.
Aluminum	2.75	volumes.
Lead	0.15	volume.

At red heat palladium goes up to 900, and is as high as 950 volumes when used as an electric cathode, the volumes occluded being retained when the metal is cold and exposed. It is probable that at the high pressure proposed the absorptive value is much greater; but taking it at 900 only the size of the cell will be much reduced.

(F) The atomic weights of palladium, nickel, lead, and aluminum are respectively 106, 59, 207 and 27, and it will thus be seen that palladium is not a heavy metal relatively to lead. It is, however, very expensive, and the question is whether the amount required would be so large as to make its use impossible from the point of view of price.

The price of palladium, commercially pure (wholesale), is about 5 guineas per apothecary ounce. Now, the specific gravity of palladium is 11.4 (Thorpe says 12), hence 1 cu. in. would weigh $\frac{62.5 \times 11.4}{1{,}728} = .41$ lb. or 6.6 oz. Therefore the cost per cubic inch of commercially pure palladium is 6.6 × 5.25 = £34.

(G) One ampere for one second decomposes (formula from Ayrton's "Prac. Elec.") $\frac{0.01058 \times 30\,(491 + F - 32^\circ)}{h \times 491}$ cubic inch of water.

Where F is degrees Fahrenheit—assume 40 deg.

h is pressure in inches of mercury—assume 5,000 in. = 2,500 lbs.

Then—

$$\frac{0.01058 \times 30\,(459 + 40)}{5{,}000 \times 491} = .000061 \text{ cubic inch of water.}$$

Accordingly 100 ampere-hours will decompose .000061 × 100 × 60 × 60 = 21.2 cu. in. of water.

If 100 ampere-hours are required to dissociate 21.2 cu. in. of water, then the evolved hydrogen and oxygen gases would on recombining give 100 ampere-hours less the efficiency of the apparatus, and the cell would consist of 7 cu. in. of compressed oxygen gas and 14 cu. in. of hydrogen absorbed into the palladium plate.

Assuming the absorptive value of the palladium to be 900, then its cubic contents would have to be $\frac{14}{900} = .0155$ of a cu. in., and the cost of .0155 cu. in. of palladium at £34 per cubic inch would be .0155 × 34 × 20 = 10s. 6d. That is to say, the cell requires 10s. 6d. worth of palladium.

(H) As the quantity needed is small, while the area of the plate must of necessity be large, the plate might be made of a lead grid with the palladium deposited upon it in the spongy

form. The plate of lead being ductile would allow of vibration, but it would require to be of small sectional area in order to allow for the expansion and contraction of the palladium, as this metal extends laterally about 1.6 per cent. during the absorption of 900 volumes of hydrogen.

(I) Every one knows how much the electric automobile is handicapped as compared with the steam or petrol-driven car; how it is impossible to travel across country or for very long distances in towns because of the necessity of having the cells recharged or else replaced by a new set ready charged. Who knows, therefore, but that the solution of the problem may be found in using the high pressure gas accumulator and recharging by buying compressed or liquefied hydrogen and oxygen gas from licensed dealers in much the same way that one now buys petrol? It is conceivable that one might carry enough compressed gas on the car to enable runs of longer duration to be made than even the petrol-driven car is at present capable of. There is also, of course, the alternative of charging up the cells in the ordinary way in case the gases were not available ready made.

(J) With regard to the efficiency of such an arrangement, it is particularly interesting at the moment to note that in the November issue of the American Electrician there is a detailed description of an electrolytic generator constructed and tested at the physical laboratory of Lehigh University. The two gases are given off 99.9 per cent. pure, the impurity in the oxygen being hydrogen, and vice versa. With a current of 10 amperes the e.m.f. required per cell was 3.6 volts, which gave an efficiency of $\frac{1.45}{3.6} = 40.4$ per cent. The value 1.45 being the theoretical e.m.f. in volts required to push 1 ampere through an electrolytic cell for one second.

The conclusions arrived at by W. S. Franklin, the writer of the article, are: "That the electrolytic generator is entirely satisfactory in every particular. There is no corrosion of the electrodes, and the hard rubber withstands the action of the caustic soda perfectly. The efficiency under practical conditions is as high as 40 per cent., and oxygen and hydrogen may be produced more cheaply by means of this generator than by any other method."

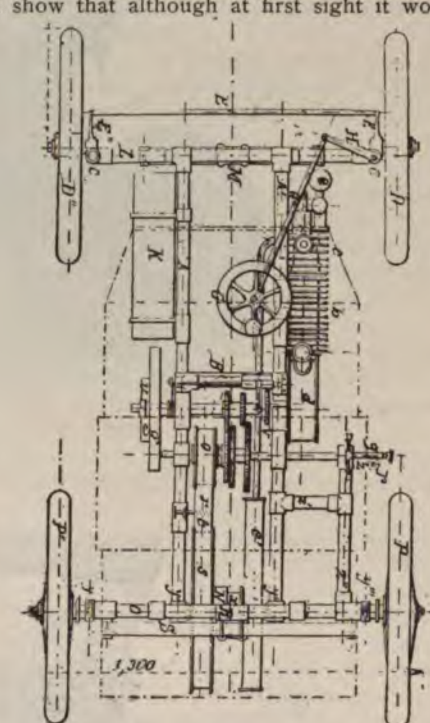
Greater efficiency is, as a rule, the natural result of working at greater pressures. Possibly, therefore, the efficiency of the apparatus might reasonably be very much higher than 40 per cent. Chi lo sa, as the Italians say.

The foregoing is taken from the Automotor Journal and well illustrates the main difficulty in power storage. Weight is the ever present bugbear through the long line of attempts at useful reservoirs, from fly wheels and springs to the most intricate chemical and mechanical combinations. Pressures of 3,000 lbs. and upward in connection with chemical decomposition of such a drastic nature as the one proposed involve heavy tanks and other evident disadvantages, while palladium at near $40 an ounce—American prices—is almost prohibitive.

However, the article is an interesting contribution to the scanty literature of a subject which, so far as motor vehicles are concerned, is of academic rather than practical value.

THE NEW BOLLÉE VOITURETTE.

The three-wheel Bollée voiturette is now a well-known motor vehicle, as well in America as in this country. La Société des Voiturettes Automobiles, of 163 Avenue Victor Hugo, Paris, with the view of meeting the demands of those automobilists who prefer four wheels to three, have lately brought out a new form of vehicle, a plan view of which I am able to send you herewith. A noticeable feature in the new car is that the two passengers are arranged to sit side by side instead of tandem fashion. An examination of the plan will show that although at first sight it would appear



that considerable changes have been made in the arrangements of the motor and of the power transmission mechanism, yet that practically all that has been done has been to take the existing frame, with motor gasoline tank and speed change gear fixed, and reversing it, making the rear of the three-wheel the front of the four-wheel car. The frame is of tubular construction, the motor being located at B on the right hand forward side of the car, E being the carbureter, E' the silencer, G the fly wheels, U the starting handle. The rear road wheels are mounted on a hollow differential axle, O, supported by special links, Y, from a bridge, R, in such a way that, as in the well-known three-wheel machine, the rear wheels may be moved slightly forward, so slackening the driving belt and consequently cutting out the motor, this device taking the place of a friction clutch. Three speeds—10, 20 and 30 kilometers per hour—are provided, the power being transmitted from the intermediary shaft Q direct to the back axle by a single driving belt working on the pulleys O and S. The variable speed gear and the tightening and slackening of the driving belt are controlled by a handle, similar to that in the three-wheel voiturette, which is, however, in the new car, manœuvred by the right instead of the left hand. Steering is controlled through the front wheels by a hand wheel, G, arranged conveniently at the riders' left hand. A foot pedal controls a Lemoine brake acting on the drum x on the back axle. The wheels are of the cycle type, shod with pneumatic tires. The pressure tank for the burner and the lubricator are arranged in the front portion of the car. The motor is of slightly greater power than that employed in the three-wheeled voiturette, its new position enabling the air to have freer access to the cooling ribs. The car is comfortably

THE VALLÉE GASOLINE CARRIAGE.

NEW BOLLÉE VOITURETTE.

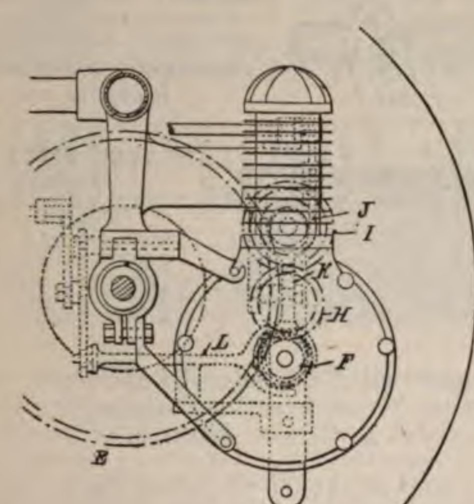
upholstered, is 7½ ft. long, 4¼ ft. wide and 4 ft. 7in. high, while its weight is given as 660 lbs., or half as much again as the three-wheel vehicle.

A NEW VALLÉE GASOLINE CARRIAGE.

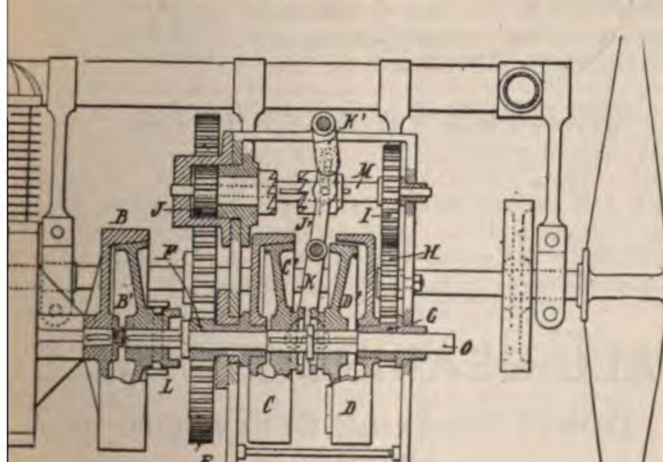
M. H. Vallée, of Le Mans, France, whose special racing carriage as already been illustrated in this journal, has just completed a new gasoline carriage, shown in the accompanying illustration. The vehicle, which can accommodate four persons, is fitted with two-cylinder horizontal motor, and is provided with three speeds, the power of the motor being transmitted from the motor shaft by belts working on fast and loose pulleys to a countershaft, and from the latter to the rear axle by the usual sprocket wheels and chains. This type of carriage can also be fitted with a four-cylinder motor with direct transmission by one belt only to a "live" axle without any chains or toothed wheels. It is comfortably upholstered, and is claimed to be an excellent hill climber.

THE CHERRIER TWO-SPEED GEAR.

The "Cherrier" is the name of the latest two-speed gear for motor tricycles and light automobiles to be brought out in France, where it is being marketed by Dalifol & Thomas, of 18 bis Faubourg Poissonnière, Paris. From the illustrations it will be seen that the motor shaft terminates in one half of a friction clutch, B. The male half of the clutch B' is carried on the end of a shaft, O, in the same line. On this latter shaft are mounted two clutches, C D, the male portions of



which, C' D', are controlled by a single lever, K, in such a way that only one of the clutches can be in gear at a time. For the high gear the two parts of the clutch C are brought into contact, the power of the motor being transmitted through the pinion F to the large gear wheel E on the tricycle axle. For the low gear the lever K is pulled over to the opposite side, thus throwing out the clutch C and bringing the two parts of the clutch D into engagement. In this position the power is transmitted to the wheel E through the pinions G H I and J. The spur wheels F and J are always in mesh with the wheel E, being so arranged that as one is driving the other runs free and vice versa. The gear is entirely inclosed in a dust proof case.



Automobiles and Bicycles.

The following paragraphs on the legal status of the automobile are from the pen of John C. Higdon, St. Louis, Mo., who is now defending a damage suit brought by the owner of a horse that was frightened by Mr. Higdon's automobile and caused an accident:

In view of the fact that the automobile is just now prominently before the public as a business and pleasure vehicle it will be of interest to review recent court decisions on the law of the road.

A street or a road is in law a public highway, and as such belongs to the public and to all the citizens thereof, and all have the right to travel thereon by their own selected modes of conveyance, whether it be as foot passengers, bicycle, ox team, a four-in-hand or an automobile. (Coombs v. Purrington, 42 Me., 332; Barker v. Savage, 45 N. Y., 196; Commonwealth v. Temple, 14 Gray, 74.)

It is now well settled that a bicycle is a carriage, and as such has an equal right to the road with all other carriages, no more, no less. (Ladd v. Allen, Supreme Court New Hampshire, 1881.)

When a traveler goes upon the public roads the law presumes that his carriage is in such good roadworthy condition as to make it fit for the journey which he undertakes, and if by the neglect of the proper care which a prudent man would give to his carriage or harness it breaks and thereby causes damage to an innocent traveler the offender may be held to answer in a suit at law. (Welsh v. Lawrence, 2 Chitty, 262.)

The law has never yet undertaken to restrain citizens from constructing their private vehicles in the manner best suited to their individual tastes, or to give to any form of private carriage any rights or privileges superior to those of any other form, provided the form is not such as will injure the roadway.

It has even been held lawful to operate a steam traction engine on a roadway, notwithstanding it was urged that horses had been frightened by it.

The drivers of horses have no more rights in streets or carriage ways than those using other common modes of conveyance, and the mere frightening of horses is neither actionable as a tort nor complainable as a nuisance, nor an obstruction which city officers or public boards are accountable for. (Macomber v. Nicols, 34 Mich., 212; Moses v. Pittsburg, etc., 21 Ill., 522; Cook v. Charleston, 98 Mass., 80; Stone v. Hubbardston, 100 Mass., 50; Keith v. Easton, 2 Allen, 552; McFarland v. Brown, 1 Bicycling World, 27.)

To say that a new mode of passage shall be banished from the streets, no matter how much the general good may require it, simply because streets were not so used in the days of Blackstone, would hardly comport with the advancement and enlightenment of the present age. (Moses v. Pittsburg, etc., R. R. Co., 21 Ill., 522.)

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

FOR SALE.

Gasoline carriage, 4 h. p. well-balanced motor. In successful operation.

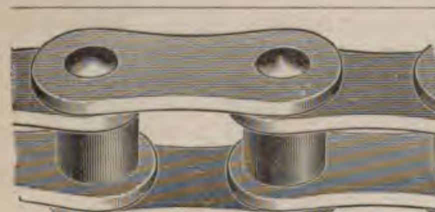
S. S., care of HORSELESS AGE.

FOR SALE.

HAYNES-APPERSON PHAETON. Latest model. Finest finish. In perfect order—been run about one hundred miles. Immediate delivery. Price, $930. List price, $1,220. Apply THE HAYNES APPERSON CO., Kokomo, Indiana.

FOR SALE TO ANY ONE.

A Stanley Locomobile, No. 1 Stanhope Model, in perfect condition. Has been run 450 miles. Full printed instructions. W. E. JACKSON, JR., P. O. Box 604, Augusta, Ga.



Drive Chain,
SPROCKETS.
GEARS. 3,200 Sizes.
Compensating Gears. Steel Balls, etc. . .
Boston Gear Works,
138 Purchase St.,
BOSTON. MASS.

Seamless Cold Drawn Steel Tubing, Shells, Cylinders and Tanks, For Air, Gas, Steam, Ammonia or fluids under pressure and explosives. ☞ Seamless Steel Tested Tanks of Sundry Diameters.

DROP FORGINGS AND STEEL STAMPINGS.

JANNEY, STEINMETZ & CO., Drexel Building, Philadelphia, Pa.

DRY BATTERIES
For Sparking Gas and Gasoline Motors.

LONG LIFE, RELIABILITY, HIGH VOLTAGE.
IN SUCCESSFUL USE FOR THIS PURPOSE.

Dow Portable Electric Assistant Co., 218 TREMONT ST., BOSTON, MASS.

LEONARD HUNTRESS DYER,
Specialty: Patents and Patent Causes,

908 G Street, N. W.

Cable Address: "Dyerpatent, Washington." **WASHINGTON.**

Complete drawings of an Automobile showing and describing each part in detail, differential, steering, transmission, body, etc., with dimensions, $5.00. Suitable for any power. Parts and supplies. AUTOMOBILE SUPPLY CO., St. Louis, Mo.

GASOLINE ENGINE CASTINGS.

One to four h. p., for stationary marine or vehicles; rough or partly finished. Also complete engines, carbureters and accessories. LOWELL MODEL CO., Box 292, Lowell, Mass.

BALDWIN DETACHABLE CHAINS made for Automobiles, in sizes to suit all requirements. Prompt deliveries made. Address:

BALDWIN CYCLE CHAIN CO.,
WORCESTER, MASS., U. S. A.

THE JUMP SPARK LEADS
Give Thick
1 Inch Jump Spark.
Weight, 3 lbs.
Dimensions, ?x4x4 ins.
Patent Applied For.
C. F. SPLITDORF, ELECTRICAL SPECIALTIES.
21 Vandewater St., New York

Machinist with 15 Years' Experience in Oil Motors and Automobiles in France, Germany and America wishes position as foreman or to take full charge of manufacturing the same. Formerly foreman of large Motor Works near N. Y. Address "MOTOR," care HORSELESS AGE, N. Y.

AUTOMOBILES MANUFACTURED.

Automobile Motors and Parts built according to your own plans, or we will furnish plans for your approval.

Our men are experienced in this line and we make a specialty of reducing new inventions to a practical and commercial form.

THE AVERY & JENNESS CO., 28 W. Washington St., Chicago.

FOR SALE.

Stanley Locomobile No. 2, Stanhope model. Cost $750. In perfect condition. Has been run less than 100 miles making professional calls. Price $725. Owner wishes to buy a Stanhope Model No. 3, specially suited to physician's use FRANK L. McKEE, M.D., P. O. Box 1035, Plymouth, Pa.

WANTED TO EXCHANGE.

Handsome matched, standard bred, gentleman's road team, with rubber tired buggy, pole, shafts, single and double harness; all in first-class condition; cost over $1,000.00. Will exchange for a Stanley Locomobile in good condition. Address C. A. BENJAMIN, 501 S. West St., Syracuse, N. Y.

BALL BEARINGS, ANY STYLE, TO ORDER.

DODGE MACHINE SCREW CO.,
BOSTON.

Estimates Cheerfully Given on All Varieties of Turned or Punched Metal Parts.

SUCCESS.

IT has been demonstrated over and over again that the Winton Hydro-Carbon System Motor Carriage is a practical success.

Two years ago (after three years spent in study and experiment) we offered our first lot of Automobiles for the market. They operated successfully. Upon that successful foundation we have continued to build. Many improvements have been made,—substantial improvements, which have reduced our motor and carriage construction to the minimum of simplicity, so that the average intelligent mind, without previous mechanical knowledge, can quickly arrive at a perfect understanding of all working parts. What we have to offer the buying market at this time are high grade productions born of experience. Students of the motor carriage subject recognize and appreciate that this is so.

The Automobile Club of America has decided that a Winton Hydro-Carbon Motor Carriage shall represent it and compete for first honors in the International Race to be held in France during the coming season. This club's membership includes all the leading automobilists in America. If our production was not practical and thoroughly reliable the Winton Motor Carriage would not be called upon to win American honor in this prospective great event.

WRITE FOR CATALOG.

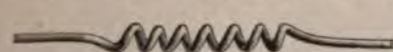
THE WINTON MOTOR CARRIAGE CO.,

CLEVELAND, OHIO, U. S. A.

AUTOMOBILE MANUFACTURERS

SHOULD EXAMINE

PATENT No. 639,490, DATED DEC. 19th, 1899,



FOR

FLEXIBLE TUBE CONNECTION

BETWEEN GASOLINE TANK AND BURNER.

Arrangements can be made for the use of this by applying to the patentee,

T. R. ALMOND,

83 & 85 Washington Street, BROOKLYN, N. Y.

HAND AND POWER PUMPS For Users and Makers of Automobiles and Pneumatic Tired Wagons. . . . . . .

GLEASON-PETERS AIR PUMP CO.,

MANUFACTURERS,

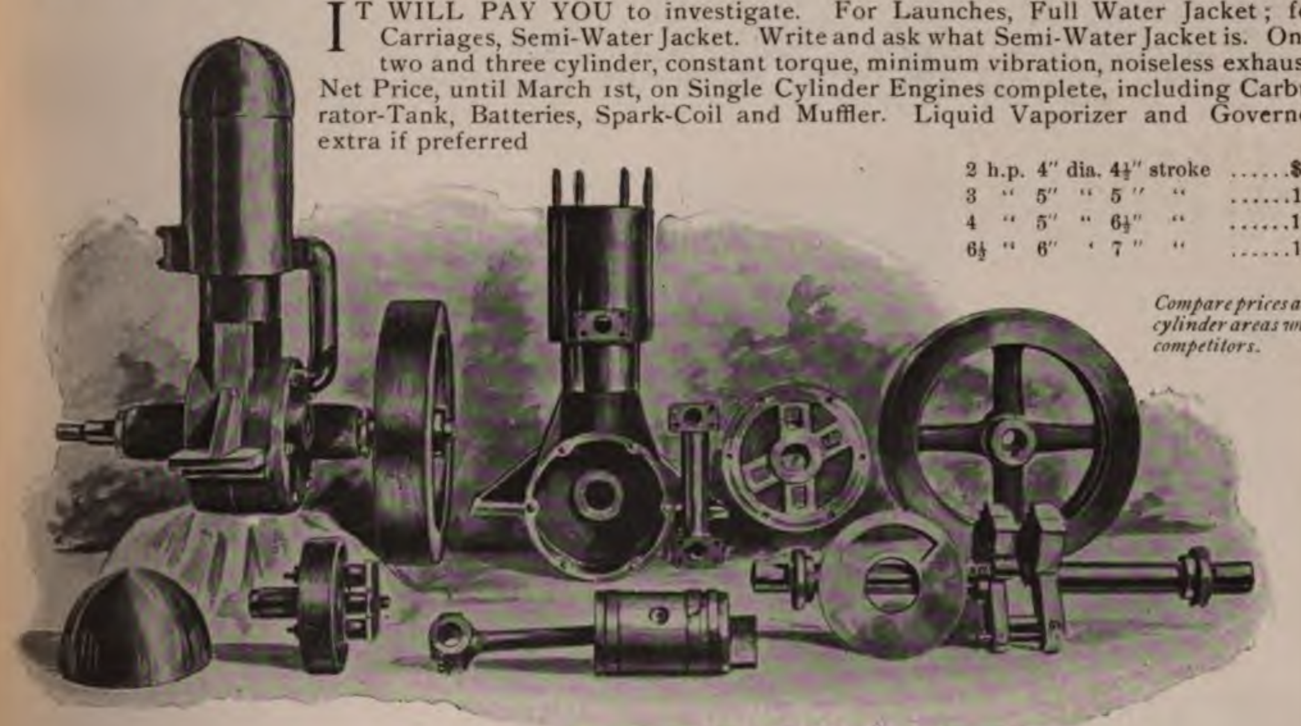
20 WEST HOUSTON STREET, NEW YORK, U. S. A.

HERE IS A RELIABLE TWO-CYCLE ENGINE

IT WILL PAY YOU to investigate. For Launches, Full Water Jacket; for Carriages, Semi-Water Jacket. Write and ask what Semi-Water Jacket is. One, two and three cylinder, constant torque, minimum vibration, noiseless exhaust. Net Price, until March 1st, on Single Cylinder Engines complete, including Carburator-Tank, Batteries, Spark-Coil and Muffler. Liquid Vaporizer and Governor extra if preferred

2	h.p.	4″	dia.	4½″	stroke	......	$75
3	"	5″	"	5″	"	......	100
4	"	5″	"	6½″	"	......	135
6½	"	6″	"	7″	"	......	175

Compare prices and cylinder areas with competitors.



IN ADDITION TO OUR ENGINES WE OFFER THE FOLLOWING LINE OF GOODS:

A reliable, simple, and trustworthy **reversing screw-wheel** which is sold with or without our engines.

A simple and substantial **rear axle and differential gear** for medium weight run-abouts and also for heavy carriages of any type.

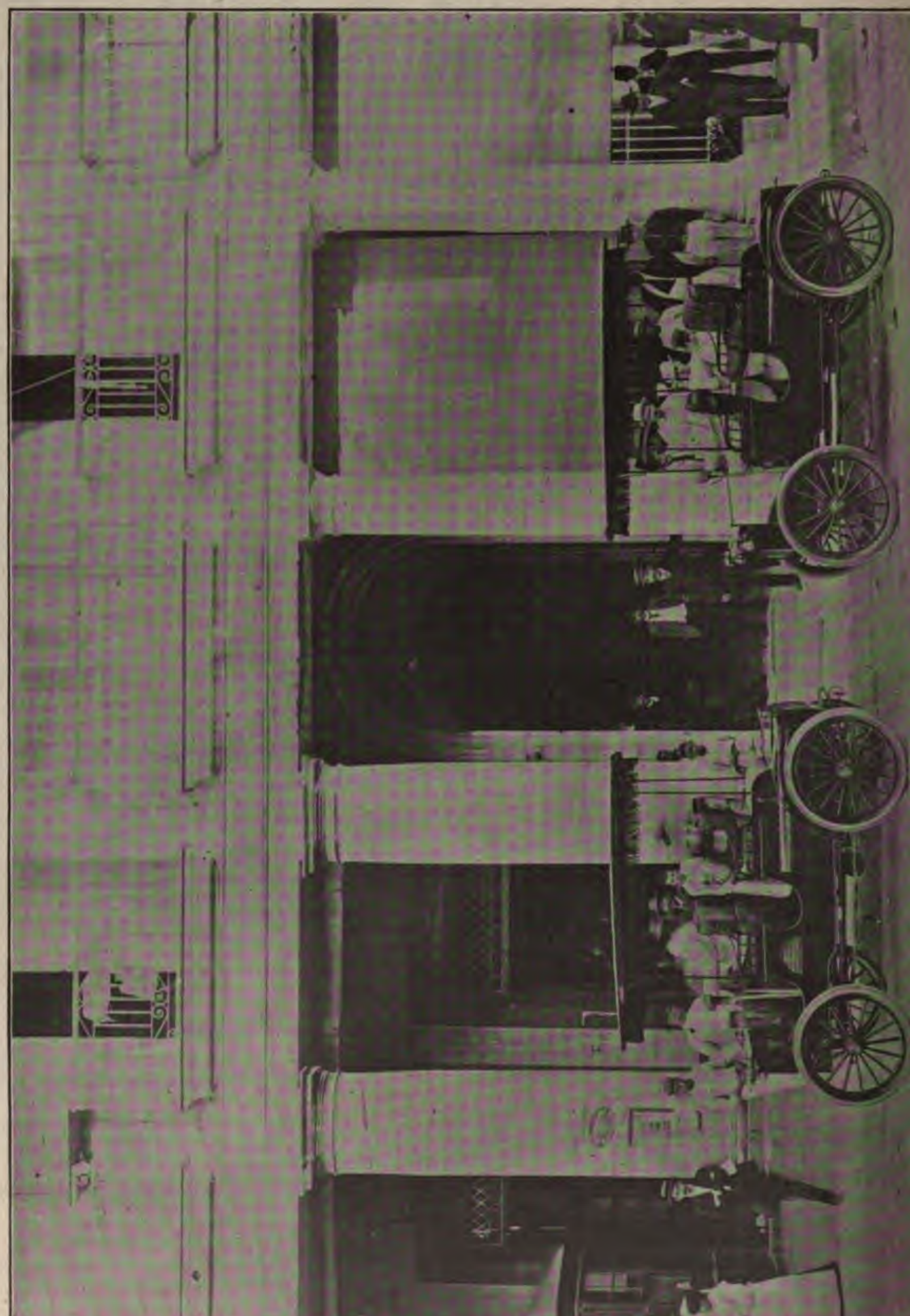
A speed change gear and power transmission of simple, reliable, and appropriate design, more particularly adapted for use in connection with our own engines.

A strong, neat, and moderate priced **running gear** for moderate weight carriages.

We are in a position to negotiate, on the most favorable terms, for the purchase of **Boats and Launches,** and are prepared to take contracts for entire equipments.

Send 50 cents for WORKING MODEL and technical description of our engine, of great value to anyone interested in gas engine work.

THE DENISON ELECTRICAL ENGINEERING CO., New Haven, Conn., U. S. A.



OFFICE OF THE HAVANA AUTOMOBILE TRANSFER CO., 87 Prado St., Havana, Cuba.

THE

GEOMETRIC LINE

ools for screw machine work are used and recommended by all leading manufacturers because they possess so many points of superiority over old methods.

ou are interested in screw machine work of any kind it will pay you to investigate this line of

stable Self-Opening Screw Cutting Die Heads,
Adjustable Collapsing Taps, and
Adjustable Hollow Milling Tools,

Manufactured by the

EOMETRIC DRILL CO.,

Westville, Conn., U. S. A.

DESCRIPTIVE MATTER ON DEMAND.

The Whiton Universal Automatic Gear Cutting Machine.

Most complete **Gear Cutter** yet designed. Specially adapted to the requirements of Motor Vehicle Manufacturers. Already in use in several leading shops.

SEND FOR FULL PARTICULARS AND LIST OF USERS.

THE D. E. WHITON MACHINE CO.
NEW LONDON, CONN., U. S. A.

BOILERS AND ENGINES

FOR VEHICLES.
STEAM CARRIAGES.

Carriage Boiler, Class A.

STEAM CARRIAGE, DOS-A-DOS STYLE.

Engines and Boilers Built to Order.

Also Steam Delivery Wagons and Omnibuses

Carriage Engine, Class B.

EDWARD S. CLARK,

STAMPS FOR CIRCULARS.

272 Freeport St., Harrison Square, Boston, Mass.

THE WOODRUFF PATENT SYSTEM OF KEYING

Is used by The Largest Automobile Works in this Country. For Keying Gears, Sprockets, Cranks, etc., to Shafts. . . . .

WE CARRY 41 SIZES OF KEYS AND CUTTERS IN STOCK.

SEND FOR CIRCULAR.

THE WHITNEY MANUFACTURING CO.,
HARTFORD, CONN., U. S. A.

HIGH GRADE GASOLINE

AUTOMOBILE AND MARINE ENGINES.

THE CHARLES B. KING CO., DETROIT, MICH.

HASBROUCK AUTOMOBILES AND LAUNCHES.

EQUIPPED with **The Hasbrouck Motor**, the **ONLY ABSOLUTELY Odorless Gasoline Engine** on the market. We say **odorless** and we **MEAN odorless**, and will **demonstrate** it to any one wishing to investigate. It is **NOISELESS** and **ABSOLUTELY SAFE.** Automobiles in Runabout and Surrey styles. Modified Stanhope pattern. Launches from 20 to 50 feet.

ORDER NOW FOR SPRING DELIVERY.

HASBROUCK MOTOR CO., 68 Broad Street, New York.

Size, 7 high X 4½ for Stationary Engines.
Size, 7 high X 4 for Automobiles.

O K DRY BATTERY.

NEW GAS ENGINE TYPE.

THE PROBLEM SOLVED.

No solution to slop over. No missing of sparks. Highest voltage. Quickest recuperation. Long life. Unaffected by heat or cold. Compactness.

Non-Polarizing Dry Battery Co.,
625 BROADWAY, NEW YORK.

POINTS IN ORDERING.

1. Name of engine.
2. Number of revolutions per minute.
3. Number of sparks per minute.
4. Mode of ignition, whether by spark coil or induction coil.
5. If spark coil, whether butting or wiping spark.
6. Kind of spark contact points, whether platinum, steel or other material.
7. Average number of hours per day engine is run.

// THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. V. NEW YORK, JANUARY 17, 1900. No. 16.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

The Explosive Motor.

We have called this our Explosive Motor Number, because it is devoted exclusively to that type of motor in which power is developed by an explosion as contradistinguished from a more gradual expansion of gases in the cylinder.

Some of our friends have told us that they think the name a mistake, and one of our readers, quoted elsewhere in this issue, believes it a misnomer, contending that no explosion takes place in the cylinder of a gasoline engine. Those who object to our title take the ground that it is likely to mislead the public and inspire them with further dread of a machine which generates its power in so violent a manner and which on this account has been falsely described as "dangerous" by rival interests.

We differ from our friends in this matter. We believe the best way to promote an honest industry is to tell the truth about it. If there is a bogy, a superstition or a delusion of which mankind are ignorantly afraid, we believe the wisest course is to drag it into the light of day, expose its weakness and destroy it. Falsehood should be met with truth, misconception and error with explanation and free discussion. Concealment and evasion will only perpetuate their hold upon the human mind. Gasoline motors are explosive motors. According to the best English usage an explosion is the violent shock due to the ignition and rapid expansion of gases, and this is exactly what occurs in the cylinder of a gasoline motor. But such motors are not dangerous on this account—i. e., liable to explode. Far from it. The term merely applies to the method of generating power within the cylinder by means of the ignition of an explosive mixture of hydrocarbon vapor and air. Inside the cylinder only does the vapor come in contact with fire, and there in the exactly measured proportions necessary to produce an explosion. The small supply of gasoline carried on the vehicle is kept in a tank at a distance from the motor, and when electric ignition is employed there is positively no fire possible except from the careless handling of the fuel in renewing the supply in the tank. So far as safety is concerned, therefore, the gasoline vehicle is almost on a par with the electric vehicle, in which fire and even explosion are not wholly unknown in consequence of the crossing of wires or the generation of inflammable gases from the storage batteries. As compared with the steam engine, the explosive motor has the advantages of not burning fuel in the open air, as is necessary up to the present time in steam vehicles, of lower fuel consumption, and of dispensing with the boiler altogether. Important points of superiority of the gasoline over the electric vehicle are lighter weight, wider radius, cheaper first cost and operation, ease of obtaining fuel and much greater durability and general availability. There is about the gasoline vehicle no part approaching the storage battery in delicacy and liability to get out of order.

Producing power with such rapid combustion and with such liberal use of free atmospheric air, the gasoline or oil motor is, in its consumption of fuel, the most economical power known.

But the perfect ideal is no more to be found in motors than in other things. The gasoline motor has certain drawbacks directly traceable to the explosive character of its impulse. To withstand the shocks of the explosions a heavier construction is required than is necessary in the steam engine (somewhat heavier, even, than the entire steam plant of engine and boiler combined). A fly wheel of substantial weight must be used in order to store up energy between impulses, and the regular and reliable ignition of the explosive mixture in the cylinder is not easily attained by the electric method, which is admittedly preferable to the hot tube for vehicle service on the grounds of safety and ease of regulation or timing.

Perhaps the ignition difficulty is the most serious one encountered by the average maker and user of gasoline vehicles in the United States to-day, and we have therefore devoted considerable space in this special issue to that subject. Vibration is no doubt a serious objection against the explosive motor, but its importance has been somewhat exaggerated by the American public, whose education in motor vehicles has been too much confined to the hostile and one-sided criticisms of the Lead Cab Trust. If it were not possible to improve upon the best existing models with respect to vibration, the gasoline vehicle would still have a great field before it in the horseless era. Excessive vibrations are experienced only when the vehicle is at rest and the motor running, and as these conditions seldom co-exist, the objection may be classed among the many hypercriticisms which a finical and uninformed public have passed upon this vehicle motor of such great and certain promise.

Another weak point in explosive motors, particularly those of the early experimental period, is the disagreeable odor of the exhaust; but the editor is of the opinion that this trouble in almost every instance can be traced to faulty mixture and unreliable ignition—i. e., incomplete combustion or no combustion at all. With careful attention to these two points the exhaust of the explosive motor should be almost odorless.

Other commonly mentioned defects of the explosive vehicle motor are the starting by manual labor and the want of elasticity or reserve power for starting a heavy load from a standstill and for sudden emergencies. These defects are being in part overcome, the former by the use of automatic starters, which add some complication, it is true, and the latter by the use of reducing gears and by advancing the point of ignition of the explosive charge and thus increasing speed and power. The explosive vehicle motor is thus gaining in flexibility every day, although in this important particular it cannot compare favorably with the steam engine.

The reader will find in this issue nearly all the moot questions connected with the explosive vehicle motor treated in a scientific manner. We have asked our experts to delve into the subject deeply and give us the formulated data underlying this type of motor, so that we might furnish a solid foundation for future development, clear away some of the distorted notions which have taken root in regard to this motor, and give it the impetus on this side of the water which its merit deserves. On the Continent an experience of many years has determined the position of the gasoline vehicle. In the field of light work it has taken the lead over all competitors for economy and general serviceability. A like growth in popularity is sure to be witnessed here within the next few years. Our present backwardness is traceable to the undue prominence that has been given to the electric vehicle by the Lead Cab Trust, and to the complexity and newness of the problems related to it. The engineer who would construct a successful gasoline machine must carry his researches and experiments far into the fields of chemistry, mechanics and electricity. The problem of the electric or the steam vehicle is simple in comparison. The game, however, is worth the candle. In the opinion of well-informed observers the growth of the explosive motor industry within the next decade will be almost phenomenal. This power seems destined to compete with other motive powers in nearly all branches of stationary and portable service.

Great as the difficulties confronting the gasoline vehicle inventor have been, they are being fast surmounted. Public sentiment in this country, long influenced adversely by the Lead Cab Trust, is beginning to turn toward gasoline and steam as the powers best adapted to the new locomotion, and encouraged by the change our inventors and manufacturers of gasoline vehicles feel that the way before them will be much smoother than it has been in the past. Business vehicles of various kinds are now in course of construction in several factories, and before the close of the year many will probably be seen on our streets. Once they are in actual service they may be expected to give such a good account of themselves in comparison with horse service that this branch of the motor vehicle industry will soon assume large proportions.

The Explosive Motor.

The current issue of The Horseless Age has been devoted more particularly to the consideration of those features of the explosive motor that have the greatest likelihood of success in actual practice. With this object in view, the several contributors have most thoroughly canvassed the field and have gathered together a quantity of useful information that cannot fail to give a much needed impetus to the efforts of many investigators in explosive motor construction and design. The apparent simplicity of the explosive motor has led to the discredit of the motor vehicle industry in several instances. It does seem a simple thing to arrange the necessary mechanism for the introduction of an explosive mixture on the suction stroke of the piston; to have the simplest form of check valve to automatically close on the return stroke and retain the mixture in the cylinder under compression; to explode the charge and provide for the expulsion of the expanded gases, etc. There is nothing here to equal the complexity of a cheap clock. No one need feel surprise that many have rushed

hastily to work and have repented at leisure, as the peculiarities developed. The readers of The Horseless Age cannot but have noticed the attention that is paid abroad to the details of the carbureter. Several have been illustrated that apparently require as many pieces as the motors to which they were attached. It is a matter for some doubt whether the majority of our manufacturers actually realize to the full the necessity for careful attention to this detail in particular; and that the air—the spirit as well as the supply of the resultant mixture—deserves separate and thorough consideration. In another article in this issue the writer has given his reasons for such consideration and has made some suggestions in the direction of greater efficiency in carbureter construction.

The methods of ignition have also received due attention. For motor vehicle use the electrical method is likely to retain first place for some time. By this method the speed and power can be varied in two ways—first, by varying the quantity and quality of the explosive mixture, and secondly, by altering the time of ignition. By the first method, only a comparatively small variation is possible, as the charge is soon made too weak to ignite, and when the quantity drawn into the cylinder is much reduced, the compression falls until a missfire is the result. By varying the moment of ignition we get a wide range of speeds, and as in this way both means may be employed, a wide range of regulation is to be obtained for the ever changing conditions of road and traffic. If, however, the hot tube is employed, it becomes impossible to vary the moment of ignition without much complicated mechanism, and hence a good deal of the control of both speed and power is lost. Moreover, the lamp flame, used to maintain the tube at its proper heat, would be a source of great danger in the event of an accident of any kind whereby the petrol used as fuel should be exposed near the lamp. The motor would also be heated where it is most undesirable that heat should be added—i. e., the combustion chamber. In the matter of comparative cost, there is really not any great difference. Against the cost of battery, coil and sparking plug must be balanced that of extra spirit tank and air pressure pump, ignition lamp and casing, as well as the platinum ignition tube.

The strong odor from many explosion motors is often set down to the demerit of the hydrocarbon employed, and all sorts of schemes have been proposed to lessen this annoyance. To thoroughly "deodorize" or carefully refine and purify the spirit and maintain it at the requisite density is the starting point of the series of improvements. Then the complete carbureting and combustion, so far as this may be obtained, the expulsion of the gases through a cleansing medium—loose asbestos, lime, etc.—all have received more or less study and experiment.

Some of these efforts could have been directed to another feature with good advantage. The heat of the motor probably has the effect of burning the lubricating oil in the crank casing. It is very likely also that some of the oil gets on the exterior and contributes to the malodorous condition. Especially is this to be expected in a carelessly constructed machine.

Alcohol has been suggested for use in place of other hydrocarbons, but while the internal revenue charges exist at their present price it is doubtful whether its use will pass beyond the laboratory of the experimenter.

A more attractive material is promised in acetylene, though if the gas is to be generated en route the weight and complication may offset the other advantages of the hydrocarbons now in use. Different experimenters have made varying claims for both acetylene and alcohol. M. Cuinat made a series of experiments to determine the relative advantages of acetylene and ordinary gas, and found that the former required but one-third the amount to arrive at the same results with a 6-h.p. motor. But M. Moreau tells us that another worker, Ravel, has found this proportion too large, and that the correct figures should be as 2 to 1; and our author proceeds to the question of relative costs, and finally concludes "that from point of view of convenience, no less than the matter of price, there is more inducement to utilize petrol than acetylene."

M. Ringelman has made some comparative tests of alcohol and gasoline. They were carried out with the aid of a four-cycle motor—Brouhot—and a two-cycle Benz. It is not necessary to repeat his figures in detail; but to obtain like results he found it necessary to use twice the amount of alcohol to the quantity of gasoline required. Both MM. Witz and Levy have calculated the power and cost of equal quantities at the market price of each. Thus the latter gentleman finds that with alcohol he obtained 8½-h.p.; with petrol he derived 13.60 under like conditions of motor and cost.

It does not seem unlikely that some of the heavier and safer oils may come into use. Already in stationary engine practice good work is being accomplished, and the Koch and other heavy motors have been applied with a degree of success in the motor vehicle industry, and we shall look forward with much interest to the result of efforts now under way to produce a thoroughly satisfactory kerosene motor for that purpose in this country.

The extreme heat generated at each explosion in the cylinder has brought out suggestions of various stages of ingenuity and value. Among the rest a combination gas and steam motor has been tried by using alternately charges of the two things, the heat of the gas explosion maintaining the high expansive power of the steam, and the lower temperature of the latter at exhaust being an advantage to the new charge of gasoline. The arrangement is as complicated as the explosive-motor-storage battery combination, and for similar reasons is unlikely to have any great amount of success in actual use.

In reality, the gasoline motor is the highest type of compressed air engine, as it not only compresses its own air, but heats it and immediately utilizes a large portion of the heat produced in the form of power. The chief objection, from a mechanical standpoint, to the gasoline engine for propelling

carriages is the lack of flexibility of its power. This is easily provided for, however, by building the motor of sufficient power to meet all requirements, and this can readily be done without giving it undue weight. This gives it a decided advantage over all other forms of power in traversing long stretches of sandy road or in climbing long and comparatively steep grades, as it can sustain its full maximum power for an indefinite time without injury. The objections so often raised by the critics of the gasoline motor, such as vibration, odor and noise, are most effectively silenced by taking a ride in one of the latest models of the Haynes-Apperson carriage, for example, which are fitted with balanced motors that run with but little noise and no vibration.

Simplicity and high grade workmanship may be well taken as the avenues to success in the design and construction of motor for vehicles, and whatever arrangement shall lack these characteristics can be set down as an assured failure for all practical purposes; and for these reasons I have omitted mention of some designs devoid of the first necessary qualifications.

R. I. CLEGG.

Add One More to the List.

The disappearance of Walter K. Freeman, who under the name of the Auto Acetylene Co., 25 Park Row, advertised in quite a number of New York journals two or three months ago, adds another to the long list of automobile swindles, little and big. Representing that he had valuable patents and the necessary experience to build motors employing acetylene instead of gasoline as fuel, he succeeded in raising $5,000 from New York parties to construct his vehicle. He never had any patents, knew nothing about motors, and when his schemes had ripened, and a considerable sum had been realized from his advertisements in part payment for acetylene carriages, which neither he nor anybody else has ever succeeded in building, he took train for other parts, leaving his pretentious offices and his dupes behind him.

The ever recurring frequency with which that gullible individual vulgarly termed "sucker" is born into the world is proverbial, but it seems that since the automobile came into prominence all previous records of increase have been surpassed. They appear in droves and swarms and eagerly swallow any kind of bait marked "automobile." The little rascals play their little games and disappear, but the financiers are still at it.

Medicine for the Promoters.

The promoters are on the sick list. They are making efforts to appear cheerful and quiet the fears of their anxious friends; but the fact is their condition is critical. They have all the symptoms of a severe case of Lead poison, and heroic treatment is the only thing that can save them. At considerable expense and with deep solicitude for their welfare we have prepared a course of treatment for them which we hope will either kill or cure. The treatment consists of a heavy dose of science and sense—algebra, geometry, trigonometry, chemistry, arithmetic and plain statement. This is the third dose in our course of treatment, and if it does not have the desired effect we shall follow it up with more drastic treatment, as the condition of the patient befits.

Take this medicine, gentlemen of the Anglo-American-Lead Cab persuasion. It is a bitter draught for you—you are not accustomed to it—but it will do you good. It is the truth and it is not watered.

Seeing that the Lead Cabs are fairly well patronized, some persons are led to believe they are profitable. A peculiarity of the Lead Cab is that the busier it is the more money it loses.

The Hydrocarbon Engine as a Source of Energy.

By Elwood Haynes.

Ever since scientific and mathematical investigation determined that the amount of power to be derived from a heat engine depended upon the difference in temperature of the working substance at the beginning and the end of its working cycle, attempts have constantly been made to increase this difference as far as practicable, and thus utilize the greatest possible amount of heat.

On account of the widespread use of the steam engine and the readiness with which fuel and water could be obtained, most of the effort toward higher efficiency has been expended upon this form of motor and considerable improvement has been made, not only upon the engine, but upon the boiler and other appliances connected with the use of steam. Notwithstanding the fact that the steam engine is necessarily a very wasteful form of motor and that in doing the world's work it is making fearful inroads upon the coal mines, it has easily held and is still holding first place as a motive power among civilized nations. Its advantage, however, is not due to its economy, reliability nor ease of management, but to the fact that almost any kind of combustible can be utilized in operating it.

The so-called hydrocarbon motor, which (with the exception in certain cases of water and wind power) is its only competitor, is dependent upon a gaseous or easily convertible liquid fuel, which is not always readily and cheaply obtainable from nature. When, however, the source of fuel is the same, and either liquid or gaseous, the superiority of the hydrocarbon motor at once asserts itself. One of the best examples of this fact is found in any of the great natural gas districts.

The rapid substitution of the gas engine for the steam engine in the natural gas district has been almost phenomenal, and in almost every case the substitution has been made for purely business reasons, such as economy, safety and diminished cost of attendance.

The users of the gas engine who have previously used steam will always say that the gas engine is superior in almost every respect to the steam engine, and that their gas bills, as shown by the meter, are only from one-fourth to one-fifth as much as when steam was used, while the trouble and annoyance is far less, and danger from explosion is entirely eliminated. It may seem strange to some, but the most striking characteristic of the gas engine when used under varying loads, is its steadi-

ness. This is due to the fact that the governor works through a very short range, and the slightest change in its speed serves to throw it in or out. This steady motion is especially characteristic of double or triple cylinder engines.

Let us now consider the adaptability of the gasoline motor to carriage propulsion. In the outset it will be generally admitted that lightness is one of the desirable features of a high speed carriage; but, on the other hand, it will also be conceded that the carriage should not be made too light for proper strength. The question of design and strength of material both have an important bearing just here.

But without taking up these matters, there will doubtless be established in time a more or less definite ratio between the weight of the carriage and its load.

The load should embrace not only the passengers, but the motor and its equipment. The ratio should be about the same for all forms of power, and from a dynamical standpoint the fitness of a given motor for carriage propulsion will evidently depend largely upon the number of horse-hours it will give for a given weight of carriage and equipment. The three sources of power which have thus far proven of practical value for carriage propulsion are steam, electricity and gasoline. Many extravagant and foolish claims have been made for liquefied gas, compressed air, springs, etc., but these have done little or nothing in a practical way toward substantiating the more or less preposterous claims made by their advocates.

The following table shows approximately the weights of equipments of steam, electric and gasoline carriages, as taken from results actually obtained thus far:

	Steam.	Electricity.	Gasoline.
1. Weight of carriage........	375 lbs.	650 lbs.	600 lbs.
2. Weight of water...........	300 "		100 "
3. Weight of battery..........		1,420 "	
4. Weight of fuel.............	20 "		30 "
5. Weight of motive power and drive gear...........	120 "	150 "	450 "
6. Weight of passengers......	300 "	300 "	300 "
7. Total weight	1,115 lbs.	2,520 lbs.	1,480 lbs.
8. No. horse-power (average).	3.	3.	8.
9. Maximum horse-power ...	6.	6.	8.
10. No. Horse-hours	9.	15.	40.
11. Weight of equipment per horse-hour	49 "	104 "	12 "
12. No. hours run	3.	5.	5.
13. Distance traveled	45 mi.	35 mi.	100 mi.
14. Average speed per hour ...	15 "	7 "	20 "
15. Maximum speed per hour ..	30 "	15 "	30 "
16. Average cost per mile.......	$ .01	$ .03	$ .00$\frac{6}{10}$
17. Average cost per mile per passenger..................	.00$\frac{1}{3}$	.00$\frac{1}{2}$	.00$\frac{2}{10}$
18. Weight of carriage per lb. of load..	$\frac{1}{2}$ lb.	$\frac{35}{100}$ lb.	$\frac{6}{10}$ lb.
19. Weight of carriage and load per H. P.............. ...	371 lbs.	840 "	185 "

A careful examination of the above table will show that for long distance travel the gasoline carriage easily takes first place, as it will sustain a full 8-h.p. for 5 hours at a time on a single set of supplies.

This is most strikingly shown in 10, which shows the relative number of horse-hours to be as follows for a single set of supplies: Steam, 9; electricity, 15; gasoline, 40. This characteristic shows why the gasoline carriage has always defeated all competitors on long distance runs.

This advantage seems to be a fundamental one, as the large water supply required for the steam carriage and the heavy battery necessary for the electric carriage make it impossible for them to run long distances on a single set of supplies.

The comparative lightness of the gasoline carriage renders it capable of making fast time for either long or short distances. In the opinion of the writer a gasoline carriage could be built which could readily run a mile in considerably less than one minute on a smooth and level course. Such vehicles whether driven by steam, electricity or gasoline are, however, practically worthless except for racing purposes.

The great energy developed by the combustion of gasoline is not realized by the general public, and to the majority of persons it may seem incredible that there is far more energy developed by the combustion of a pound of gasoline than by the explosion of the same weight of nitroglycerine. In fact, weight for weight, gasoline is capable of developing about eight times as much power as nitroglycerine. Or, in short, gasoline develops more energy for its weight than any substance in extensive practical use, and notwithstanding the fact that our best gasoline motors utilize only about one-fourth of its total energy, we utilize from it more than twice as much power as is contained in an equal weight of nitroglycerine, which latter is one of the most powerful explosives known. How ill-considered, then, the attempts that have been made to drive carriages by means of gunpowder or other expensive and dangerous explosives.

General Deductions.

By Henry W. Struss.

The experiences of inventors going into an entirely new branch of engineering are probably very much alike. They get all the literature to be had, study the patents that have been issued and the machines in actual operation, and then begin designing and making what they consider will be improvements on what has been done.

It doubtless appealed to a great many that the internal combustion motor, in spite of its limitations, was the most suitable for motor vehicle use on account of its simplicity (which is, however, somewhat deceptive), its economy in running and its freedom from danger with ordinary care. With electric ignition it can be started instantly. Enough fuel and water for a long run can be carried along, and the fuel can be obtained in nearly every village of any size.

In the case of gasoline motor vehicles some three or four years ago, very few details were to be had. There were a number of makes in actual operation in Europe and finding a large sale, yet when specimens were brought here they were not found satisfactory, but were more or less experimented on for the purpose of improvement. American inventors generally seemed disposed to start off on original lines, and, while this has doubtless delayed the production of vehicles here for sale, it will ultimately be of benefit to the industry.

In the designing of the gasoline vehicle (it should be considered as a whole) no doubt the most essential part is the motor and its various parts, especially the ignition apparatus and the vaporizer or carbureter, yet the gearing for transmitting the power from the motor to the wheels is also of the utmost importance. Both the motor and the

gearing, as also the controlling levers, should be of the simplest nature so that any novice can easily keep them in good running order. Not taking into consideration the tricycles and other light vehicles, the European carriages generally seem to have an unnecessary number of parts in the transmitting mechanism, which alone makes them heavier than necessary.

After study of the subject, the writer came to the conclusion that a motor of four cylinders would be the best on account of the lighter explosions necessary, as well as the smaller weight of fly wheel required, and in building one the result was all that could be expected. Practice, however, showed that one or two cylinders are better for general use on account of the smaller number of parts, even if the question of cost is not considered. It should, however, be perfectly balanced, at least mechanically.

American inventors—no doubt, on account of the attendant risk in case of accident—have not employed the ordinary hot tube for ignition, but have adopted electric ignition, some using the primary current, others the secondary from an induction coil. In the former moving contacts within the cylinder and the extra mechanism required are a disadvantage; on the other hand, the current from an induction coil requires a very careful insulation. Electric ignition has the advantage also of being easily adjusted so as to come at various points of the compression, and can be varied while the motor is running, and the current can be generated by a small dynamo or magneto driven by the motor.

Coming to the carbureter, almost any form of apparatus designed for supplying a proper mixture of gasoline vapor and air will answer for a governed motor, but where it is intended to run the motor at various speeds it is necessary, to get good results, to arrange for this variation of speed. Carbureters, so called (rather large to use in a carriage), have the advantage of not being liable to clog up, but vaporizers take so much less room and require such a small constant supply from the storage tank, that they are to be preferred. The very small holes, however, of the spraying nozzles make them very liable to clog up, causing a sudden stoppage. The presence of water in the gasoline tank will have the same effect, and water does sometimes get in, but is generally detected immediately, and before starting out, if the gasoline is supplied by gravity. The vaporizer should be placed low enough to be supplied by gravity from the tank to avoid the necessity for having a pump, which is only an additional part to be taken care of and liable to get out of order.

In considering the pleasure motor vehicle, it appears to me that it should be a thing of beauty as well as of utility, and I find no excuse for making a clumsy-looking affair where a carriage is wanted. The motor and transmission, as well as the body of the vehicle, should rest on good springs. It is no doubt easier to plan a vehicle carrying the motor and transmission on a framing resting directly on the axles, but such a one will require the smoothest of pavements to give satisfaction for any length of time. So far as the vibrations from the motor are concerned, they are not to be compared with what we used to get in the old horse cars, and I see no reason why the body should rest on separate springs on that account alone.

The controlling levers should be as few as possible, yet it is not advisable to combine two or more functions in one lever indiscriminately. The steering lever may have the electric push-button for ringing the bell attached, but should not be used for starting and stopping or changing speed. The starting and stopping lever may be arranged to change the speed and even to put on the brake. As to brakes, there should always be two sets: one for regular use and preferably operated by a pedal; the other applied directly on the wheels and to be used in case of emergency.

As to the necessity for a reverse motion for larger vehicles, which would include anything that would be called a carriage, it is probably best to have the power to back the carriage, though it may seldom be used.

A properly constructed gasoline vehicle, built with due regard to the necessities of our roads, and with a view to durability, should be a source of enjoyment to the owner, and need require no more expenditure for repairs than any other machine subjected to similar strains. With ordinary care, such as all machinery requires, it will last a long while, and while there will be improvements in details and construction of the motor, vehicles and motors built to-day will still be all that can be wished for as regards speed and power, as well as reasonable freedom from disagreeable noise and vibration.

St. Louis Motor Carriage Co.'s Gasoline Vehicles.

This company, which has been experimenting for several years, and is just coming on to the market, uses a variable speed engine of either one or two cylinders, according to the style of vehicle. The engines, running gear, etc., are mounted on an angle steel frame. Every portion of the engine and gearing is easily accessible, and, if necessary, the body of the carriage may be taken off by removing a few bolts, thus exposing everything. The change of speed gearing and reverse is secured with only one friction clutch, working on the engine shaft, so that when running idle the engine is perfectly free, nothing else being in motion. The changes are accomplished quickly while running, and without noise. The mechanism is secured in a small gear box mounted on the rear axle, and the changes are brought about by shifting a steel pinion on an intermediate shaft, driven by a sprocket outside of the gear box. This sliding of the pinion brings it in mesh with different gears, thus securing the differences desired. As the gear box is perfectly tight, they are enabled to run the gears in oil, eliminating noise and wear.

The pull of the engine is taken by an adjustable arm, swinging between the engine shaft bearing and the sprocket shaft bearing outside of the gear box. Tilting of the gear box allows perfect freedom to the rise and fall of the rear axle on bad roads, and at the same time the swinging arm secures perfect chain adjustment at all times.

The rear axle is in one piece, not being cut where the differential is applied, as is usually the .ase. One wheel is driven by the axle, the other by a hollow shaft slipped over the axle. An automatic locking device on the gear box prevents a novice from stripping the gears, as it is impossible to shift them without releasing the friction clutch, and the act of throwing in the clutch automatically brings the gears into perfect mesh, locking them in this position. One lever throws in the friction clutch. Moving it forward releases the clutch; moving it further applies the brake. As the speed of the engine is controlled by a foot pedal, it is claimed to be practically impossible for any one to get rattled and do the wrong thing while driving one of these vehicles.

The above points have been covered by patents in this and foreign countries and are believed to eliminate all complicated mechanism that ordinarily takes up valuable space in a motor carriage, and give the additional advantages of making the engine much more accessible, and giving room in the back for carrying anything desired. The necessity of oiling more than once a week has also been eliminated (except engine cylinder and connecting rod), even when in constant use. This is accomplished by placing ring oilers on all bearings, which work in any weather and are said to give perfect lubrication.

The Gasoline Engine Indicator Diagram.

BY E. C. OLIVER, ENGINEERING DEPARTMENT, UNIVERSITY OF ILLINOIS.

The indicator diagram from the gasoline engine, although fully as simple as the diagram from the steam engine, seems to be less readily understood, due, perhaps, to a more limited knowledge of the action of those gases and to the comparative recent adoption of that form of motor.

For the benefit of those persons who have not an extensive knowledge of thermodynamics, but who may wish to investigate the action of the gases in an existing or prospective motor, I have endeavored to explain as simply as possible the method of constructing the theoretical card for any case, and by applying the theoretical curves to a diagram taken from an actual engine have ascertained the deviation of the practical from the theoretical.

In order to understand clearly the action of the gases in the cylinder of a gasoline motor, it is necessary to obtain some idea of the nature of the expansion and compression curves, as it is these curves that affect in the most marked manner the efficiency of the motor.

The gases in a motor, whether it be steam or those due to the explosion of a mixture of gasoline and air, are enabled to do work by virtue of the heat contained therein—that is to say, there is in gasoline, as in coal, a certain amount of latent heat which is set free when the gases are burned or exploded, part of which raises the temperature and pressure of the gas contained in the clearance space of the engine, while another part raises the temperature of the cylinder walls and head. These gases push the piston outward against a resistance due to the work being done, and this amount of work done by the explosion of the gas represents a certain number of thermal units extracted from the gases, and they are thereby lowered in pressure and temperature. There is, therefore, less heat in the gases at exhaust than there was just after explosion, due to the work done, and due to the heat carried away by the water jacket or radiated from the cylinder.

If the gases while expanding received heat from some external source so that only the pressure would vary, the temperature remaining constant, the curve would be one similar to that showing the behavior of steam expanding in an engine cylinder, the equation of which is p. v. = c.; that is, the product of the absolute pressure and volume at any point of expansion would be a constant quantity. In the gas or gasoline motor, however, we have no heat supplied from without, but on the contrary carry the heat away from the cylinder as rapidly as possible. This will cause the pressure to fall much more rapidly for a given change of volume than would be the case were the temperature kept constant. We can see this very clearly by reference to Fig. 1, where we have each curve drawn through a common point. A. X. showing the relation between the pressure and volume in an expansion when the temperature is constant throughout, this curve is called an

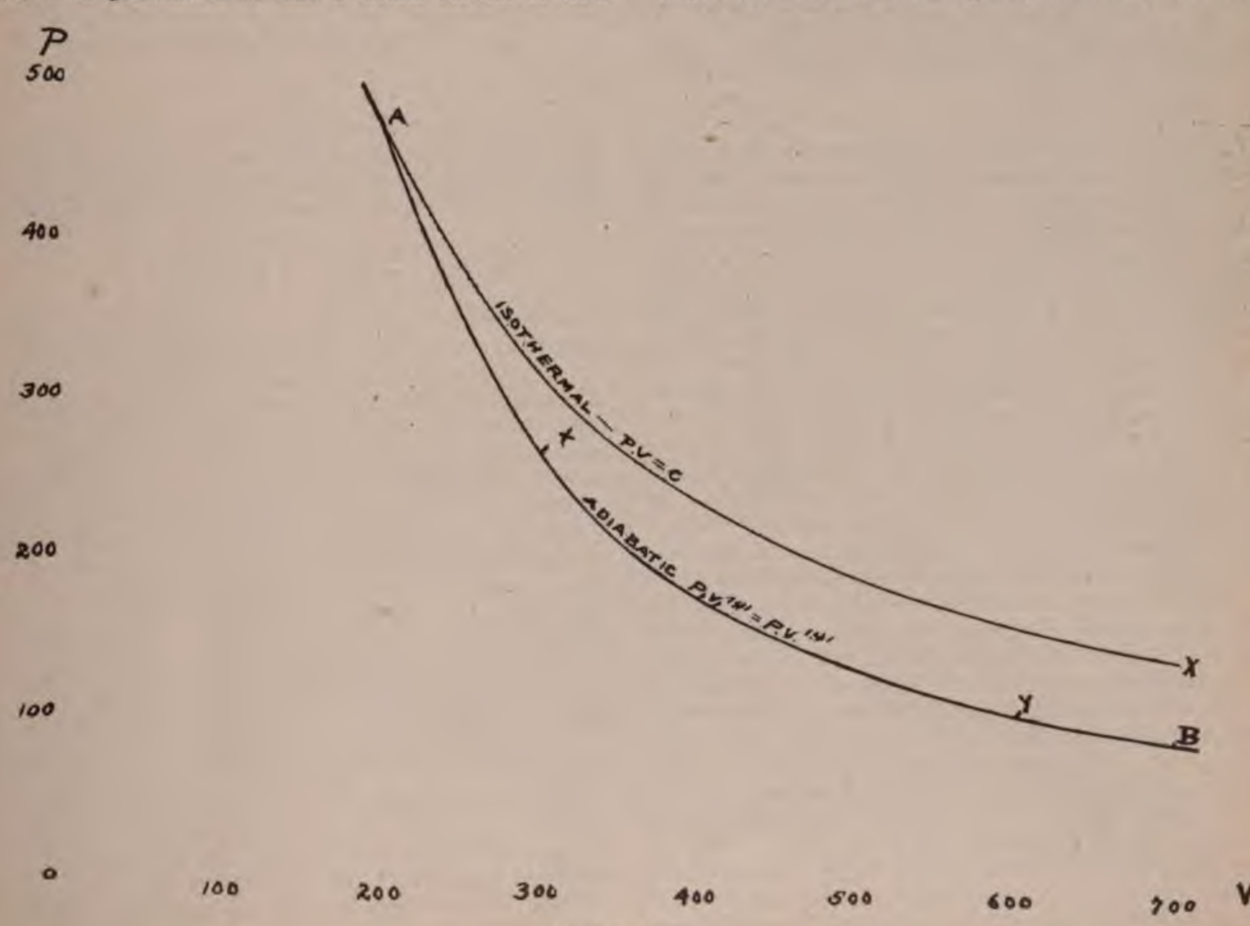


FIG 1.

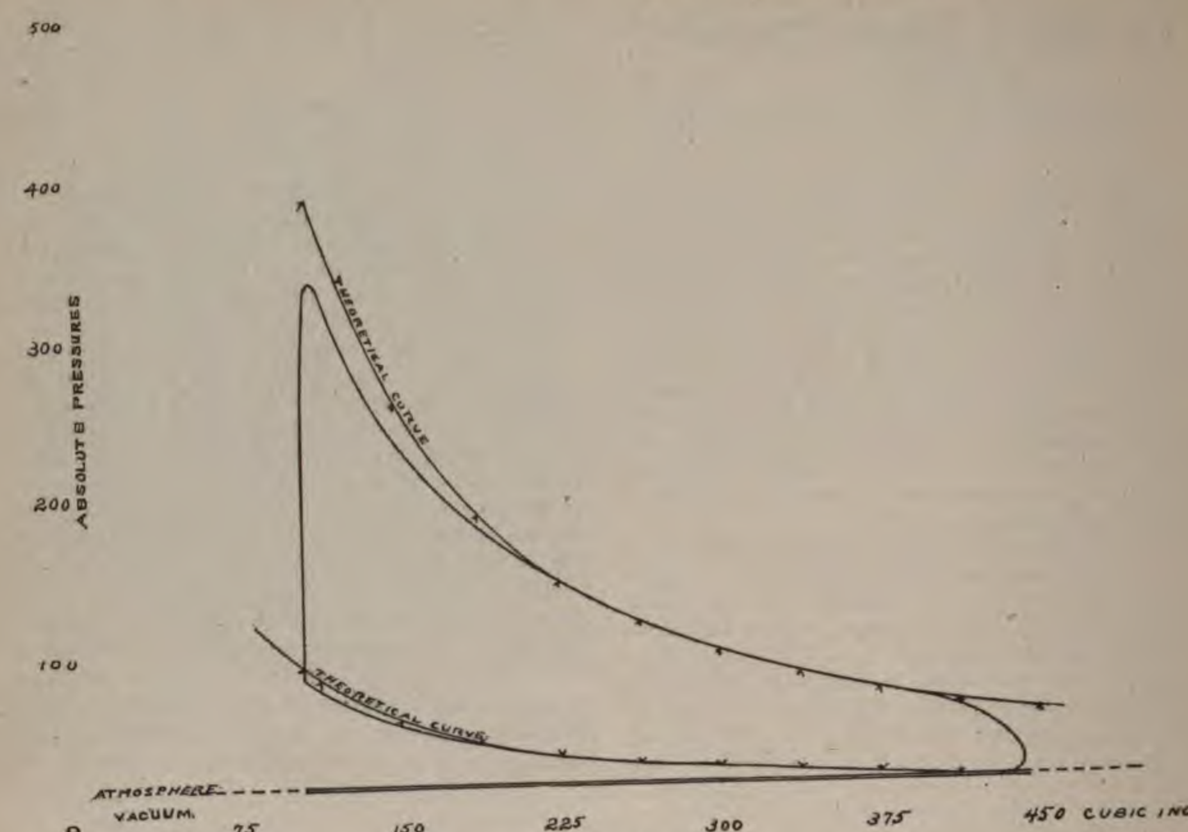


FIG. 2.

isothermal, and is represented by the equation $PxVx = PyVy$. A. B. is the curve showing the relation between the pressure and volume of a gas expanding without any means of keeping up the temperature; that is, the work done during such an expansion is at the expense of the heat contained in the gases, and is the curve of expansion which the gases in a motor follow, and hence the curve in which we are particularly interested. This curve, called the adiabatic, is much steeper than the isothermal, and is represented by the formula $PxVx^{1.41} = PyVy^{1.41}$ which relation is easily deduced by thermodynamics, P representing the pressure at any point of the stroke, and V its corresponding volume.

Now let us consider an indicator card taken from practice and see if this law really applies. Fig. 2 is such a card taken from an Otto gasoline engine 5¾ x 12½ in. with 103 cu. in. clearance, running at 300 revolutions per minute. We note that it compresses to 78 lbs., and the highest pressure of explosion is 334 lbs. per square inch. From a point A well within the expansion curve the adiabatic curve is plotted, and it follows almost exactly the actual curve of the diagram; the deviation from the theoretical in the early part of the stroke is due to incomplete combustion of the gases or the absorption of heat by the exploded gases from the metal of the cylinder, either one of which would tend to produce that effect. The adiabatic for the compression curve is also drawn in, and it shows a marked similarity to the actual. We may therefore conclude that this curve is not only the theoretical curve of expansion, but it may be used as the actual curve as well, and with very little error. It is therefore highly important to us in the study of this subject to understand the construction of this curve that we may lay out intelligently a card which we could expect for a gasoline motor we are about to design.

This curve, represented by A. B., Fig. 1, we have said, is of such a shape that the relation between the pressures and volumes of two points can be stated by the formula $PxVx^{1.41} = PyVy^{1.41}$. This formula can be changed to read

$$\frac{Px}{Py} = \left(\frac{Vy}{Vx}\right)^{1.41} \text{ or } \sqrt[1.41]{\frac{Px}{Py}} = \frac{Vy}{Vx}$$

which equations can be easily solved by the use of a table of logarithms, preferably (to myself) the hyperbolic logarithms.

Now suppose we have one point in such a curve as x of which we know the pressure and volume and wish to calculate the pressure that there will be at y when the gases have expanded to the volume for that point. Referring to the figure the pressure Px for the point x is 265 lbs. absolute, and the volume Vx is 300 cu. in., also the volume Vy for the point Y at which we wish to know the pressure is 600 cu. in. Substituting these values in the formula

$$\frac{Px}{Py} = \left(\frac{Vy}{Vx}\right)^{1.41} \text{ we have } \frac{265}{Py} = \left(\frac{600}{300}\right)^{1.41} \text{ or (1) } \frac{265}{Py} = 2^{1.41}$$

Referring to our table of logarithms we find for 2 the log. is .6931 and the logarithm for $2^{1.41}$ would be $1.41 \times .6931 = .9772$. Looking for this logarithm in the table we find .9783 opposite 2.66 which will generally be sufficiently accurate. Then $2^{1.41} = 2.66$, and substituting in (1) we have

$$\frac{265}{Py} = 2.66 \text{ or } 2.66Py = 265, \text{ therefore } Py = \frac{265}{2.66} = 99.6.$$

In the same way any number of points may be found on the curve and through them the curve may be drawn.

One of these formulæ is always available where three of the quantities are known. For instance, suppose that, as in the case of the compression curve, we have the pressure and

volume of the gases in the cylinder at some point of the stroke, and wish to know the volume of clearance necessary for a given pressure of compression, we have then Py, Vy, and Px to find Vx. We must then use the formula $\sqrt[1.41]{\frac{Px}{Py}} = \frac{Vy}{Vx}$; we divide Px by Py and find the logarithm of that number from the table. Divide by 1.41 and find the number corresponding to the logarithm thus obtained. Divide Vy by this number and we find the volume of clearance direct—a process comparatively simple and requiring only a slight knowledge of logarithms for its solution.

We now have the means of constructing the theoretical expansion and compression curves showing the action of gases in the cylinder of a given motor.

Suppose we wish to construct an indicator card for an engine we are about to design, and have decided on the following conditions: Cylinder 3 x 3, compressing from ½ the return stroke and to a pressure of 90 lbs. per square inch absolute; these being the conditions laid out by J. F. B. in his inquiry in the issue of Nov. 22, '99. He desires to know the clearance required, the terminal pressure, horse-power of the engine and the shape of the expansion curve.

On a sheet of drawing paper construct a line 3 in. in length to represent the stroke of the engine, as a. b., Fig. 3, make a mark on this line as c., from which point the charge will be compressed. Now lay off to scale at the end of this line the pressure at which the charge is exploded; this in our problem is 90 lbs., which to a scale of 1 in. = 100 lbs. would be 9-10 of an inch. It is now desired to know what clearance will give the pressure. Referring to our formula

$$\sqrt[1.41]{\frac{Px}{Py}} = \frac{Vy}{Vx}$$

We have given Px = 90, Py = 15 (atmospheric pressure), Vy = ½ volume of cylinder + clearance = 10.6 + c, and Vx = c. Then

$$\sqrt[1.41]{\frac{90}{15}} = \frac{10.6 + c}{c} \text{ or } \sqrt[1.41]{6} = \frac{10.6 + c}{c}$$

$$\sqrt[1.41]{6} = 3.53, \text{ therefore } 3.53 = \frac{10.6 + c}{c} \text{ or } 3.53\,c = 10.6 + c$$

from which we get $2.53\,c = 10.6$ and $c = \frac{10.6}{2.53} = 4.19$. The clearance required is therefore 4.19 cu. in., or 20 per cent. of the piston displacement. We must therefore add to the length of the cylinder a portion whose volume is 4.19 cu. in., or equivalent to a portion of the cylinder 9-16 in. long. Add this distance to the compression end of base line already drawn as a. d., Fig. 3. From d. erect a perpendicular d. P. This is the clearance line of the diagram. Now lay off the atmospheric line 15 lbs. above vacuum, as shown, d. b. representing the line of no pressure or vacuum. From a erect a perpendicular and mark off on it the expected maximum pressure of explosion, which will be approximately four times the absolute pressure of compression. This assumes an instantaneous and complete explosion. For this point, then, we know the pressure and volume of the gases and can compute for any other volume its corresponding pressure by the formulæ given. Take, for instance, the terminal pressure, for this point Vy = 25.40 cu. in., Px = 360 and Vx = 4.19. We have by substituting these values in the formula,

$$\frac{360}{Py} = \left(\frac{25.40}{4.19}\right)^{1.41} = 6.06^{1.41}$$

The log. of 6.06 is 1.8017; 1.41 × 1.8017 = 2.5404, which log. we find in the table opposite 12.68, then

$$\frac{360}{Py} = 12.68 \quad Py = \frac{360}{12.68} = 28.4 \text{ lbs.}$$

absolute terminal pressure, or about 14 lbs. gauge pressure. In the same way a series of intermediate points may be plotted and the expansion curve drawn through them. In a like manner we may construct the compression curve, which will complete the theoretical card. It can now be altered as seems necessary to conform to an actual card; that is, the release may be shown by a slight curve at the end of the diagram as indicated, or other changes may be made in the early part of stroke. The theoretical card will give sufficiently accurate results, however, without any alteration.

To obtain the horse-power of the engine, the simplest possible way is to compute the mean height of the card by dividing it into a number of strips of equal width and adding together the average height of these strips. Then if this be divided by the number of divisions, we have the mean height. This multiplied by the scale of the spring gives the mean effective pressure of the card, which is used to obtain the horse-power of the engine by substituting in the formula $\frac{PLAN}{33000}$ = h.p., in which P is the mean effective pressure, L the length of stroke in feet, A the area of the piston in sq. in. and N the number of explosions per minute.

The diagram Fig. 3 was divided into twelve divisions and the sum of the average heights of these devisions was 4.15 in. This divided by 12 gives .346 for the mean height of the

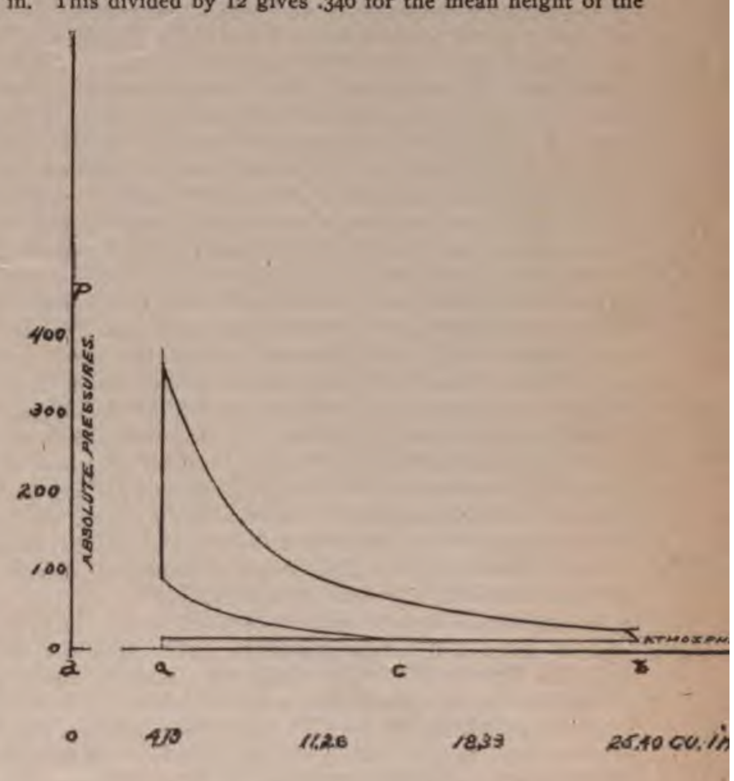


FIG. 3.

diagram. Since the scale is 200 lbs. = 1 in., the mean effective pressure would be 200 × .346 = 69.2 lbs. per square inch. Assuming 300 explosions per minute, we have for substitution in the formula P = 69.2, L = ½, A = 7.07, N = 300 and

$$\text{H. P.} = \frac{69.2 \times 7.07 \times 300}{4 \times 33000}$$ the solution of which gives H. P. = 1.11.

With these methods it should be comparatively easy for one to investigate the action of gases in the cylinder of a motor or to construct a diagram for a prospective motor to give special results.

Vaporizers and Carbureters.

By Herbert L. Towle.

The first requisite of the vaporizer of any gasoline engine is uniformity of action. The mixture in any one charge must be like that in any other charge, except when this is purposely modified for the purpose of regulating the engine. Not only this, but it is desirable on several grounds that the mixture in the charge be homogeneous throughout the cylinder. The importance of the former requirement is generally understood. Not only is there great waste of fuel, but it soon becomes impossible to manage the engine if it is neglected. It is not difficult to devise a vaporizer whose performance will be uniform with a given speed and load of the engine; but any change in these particulars may readily result in serious modification of the vaporizer's action. The need of homogeneity is less generally appreciated. It is not a feature very easily secured, and many forms of apparatus are in vogue, and in more or less succesful use, which ignore it altogether. In the writer's opinion, nevertheless, this is a serious mistake. In an ideal condition of things, each molecule of fuel has its appropriate quota of oxygen immediately at hand, and no more; and in this case combustion is simultaneous with inflammation, and its rapidity is that of the rate of flame propagation, which is determined by the richness of the mixture and the degree of compression, and may be rigidly defined for any engine in good order. Where, on the contrary, the mixture is irregularly diffused, the molecules do not readily find each other, and the combustion is apt to be very greatly prolonged from this cause, even to the point of unburned mixture and flame issuing from the exhaust port. Instantaneous combustion is not desirable in a small engine, but a combustion unduly prolonged results in back explosions, overheated cylinders and numerous minor annoyances, besides the lowered efficiency. It is highly desirable, therefore, that the gasoline be not only vaporized, but intimately commingled with the air before any portion of the charge is permitted to enter the cylinder, even if a considerable length of pipe or an ample mixing chamber be required between the vaporizer and cylinder.

A broad distinction is to be made between carbureters, properly so called, and simple vaporizers. The carbureter impregnates a portion of its air supply with gasoline vapor to saturation, and then dilutes this saturated mixture with some five times its volume of pure air. There are numberless forms of carbureters, but the leading classes operate (a) by drawing the air downward through the liquid, (b) by saturating porous material with the gasoline and drawing air past it, and (c) by spraying the gasoline itno a mixing chamber and piping the excess back to the reservoir. The first named is irregular in its action from the fact that a slight vacuum is necessary in the suction pipe in order to draw the air down against the pressure of the gasoline; and this vacuum will vary according to the speed of the piston, being greater at full speed, and practically nil at starting, unless the dilution inlet be closed. Between the second and third methods there is little in theory to choose, but the former may be considered more reliable. The prime essential with it is to have ample evaporating surface, as otherwise the air will be imperfectly carbureted at high speed. Good practice calls for not less than 5 sq. ft. of surface per horse-power, and unless the evaporation be forced by heating or otherwise, it is a great mistake to try to use less.

Theoretically the action of the carbureter is perfectly uniform. Both the carbureter inlet and the dilution inlet obstruct the flow of air somewhat, but they do so in equal proportion at all speeds; and with saturated vapor the quality of the mixture is not changed when the flow of air is stopped by the action of the governor, or by a change in the engine's speed. Practically, however, a seriously disturbing factor is introduced by the process of evaporation itself. Gasoline, like any other liquid, absorbs heat on passing into the vapor state, and this heat must be supplied from somewhere, either from the material of the carbureter walls, from outside radiation or from the air itself which is passing through the carbureter. The specific gravity of saturated gasoline vapor may vary from 1.5 to 2.5, that of air being 1, and its density is in proportion. Not only, therefore, does the opening of the dilution inlet require to be adjusted for a change in the weather, but it is more than likely to need additional adjustment after the engine is started. This difficulty may be mitigated by warming either the liquid in the carbureter or the air which enters it by the heat of the exhaust; and some such arrangement is necessary where the engine's speed is to be variable, as in vehicle service. The effect of this provision is that the engine starts with cold air, and as the carbureter becomes cold the air becomes warm from the heat generated by the engine, and the two tendencies may be adjusted to neutralizing each other. This, however, can hardly be considered an exact method. It is delicate and requires frequent attention; and until some better method is found for providing for changes of temperature in the carbureter and in the air outside, we must consider some other solution desirable. If the dilution inlet could be given an automatically variable opening, which would take care of all changes in the density of the saturated vapor as they occurred, the carbureter might be called a perfect mechanism; but it is the writer's belief that the solution of the problem is to be found in some mechanical means of introducing and diffusing the fuel, which shall be uninfluenced by changes in temperature. Devices of this latter class come under the head of vaporizers proper.

The mechanical vaporizer does not produce a saturated mixture, but is designed to admit to the stream of air only such quantity of fuel as is needed for its carburization, and no more. It may impregnate a portion of the air beyond the required density, and then dilute it; or it may supply to each portion of the air its own needed quantity at the outset. These devices of necessity introduce the gasoline in liquid form, and it is necessary to provide subsequent space or time for thorough commingling of the vapor and air. The most primitive arrangement of this class draws gasoline from the reservoir at whatever "head" it may happen to have, and admits it to the air supply by the lifting of a cam on the engine shaft. This of course allows the gasoline to flow in as long as the cam may lift, this depending on the speed of the engine; and in starting

the cylinder cannot help being "flooded." Moreover, the quantity flowing in in a given time will depend mainly on the number of gallons in the reservoir. It was early seen that no such device was practicable unless the gasoline were drawn from a constant level, and the overflow cup or its equivalent with the inflow controlled by a float is now an indispensable part of all gasoline engines. The other difficulty, however, is not so easily overcome. A makeshift is to regulate the gasoline supply by an indexed cock, and to partially close this cock when starting. This is well enough where the engine's speed is to be constant, but it is useless for motor vehicles. An improvement on it, which is found in many forms, is to control the gasoline inlet by the lift of a spring-seated air valve, so that the gasoline enters the mixing chamber only for such length of time as the suction of the piston is sufficient to lift the air valve. This, if used in connection with an overflow cup, is, within limits, a nearly perfect device. It cannot be depended upon when used with a throttling governor, and if the speed is to be variable, the gasoline inlet should be so arranged as to open most when the air valve lifts to its highest extent. In other words, the gasoline should enter most rapidly when the air is doing the same. In all such cases the air valve should be closed by a spring, so that its lift will be in proportion to the intensity of the piston's suction.

This method is used on some of the most successful engines now built; but there is another class of devices more nearly automatic in principle and much simpler in form. These consist in principle of an overflow cup placed below instead of above the air pipe or mixing chamber, and having a needle orifice projecting upward into it from below the gasoline level. The gasoline is then drawn upward by the slight vacuum in the pipe, and is sprayed into and thoroughly commingled with the air. The vacuum required for this purpose is very small, and by so placing the overflow cup that the needle orifice is as little as possible above the level of the gasoline, it may be reduced to almost any required extent. A dilution inlet may or may not be used in connection with it, but it is not necessary. The principal precaution to be observed is that the interior of the cup be in communication with the outer air, and that the gasoline be not pumped into it so rapidly as to produce a pressure within. This arrangement will not usually suffice for starting the engine. It is generally necessary either partially to obstruct the entrance of the air pipe or to introduce a little liquid gasoline into the mixing chamber. This is an objection, but not a serious one; and it is outweighed by the fact that the operaton is automatic within almost any limits of speed, an increase here resulting in greater intensity of suction and consequently a more rapid inflow of gasoline. A hit-and-miss governor may be used, or a throttling governor, if a throttling valve be put on each side of the fuel orifice, so that the degree of vacuum acting on the gasoline will not be changed. An indexed regulator should be used on the orifice, and this when once set should not need to be disturbed except possibly for a change in the grade of fuel.

The attempt is sometimes made to secure an exact fuel supply by injecting the amount required by a pump. This is correct theoretically, but in practice the minute dimensions of the pump are a constant source of trouble. One prominent firm of stationary engine builders uses two such pumps in series with each other; with what success the writer is not informed. An ingenious modification was patented a few years ago, in which the pump drew in an excess of gasoline and forced only a portion of it to the mixing chamber, the residue being forced back through a spring-seated valve. The amount going to the mixing chamber was regulated by a screw, and the objection to this arrangement is that the return valve will open soon or late, according to the speed of the engine and the consequent pressure exerted by the pump plunger.

The rise of the motor vehicle cannot fail to have an important stimulating effect of the development of all details of the gasoline engine. The conditions under which they work are vastly more arduous than those to which stationary or even marine engines are subjected; not only is the important factor of speed a wholly secondary one in these two latter classes, but the conditions of wear, exposure, careless and ignorant handling are much more serious. In addition, weight must be reduced to a minimum, and compactness and accessibility are equally imperative. In the progress which cannot fail to be developed out of these demands, the vaporizer will have its share; and if the task be difficult, the reward of success will be correspondingly rich. As in a larger sense the whole science of engine design may be said to be indebted to the motor vehicle, so the gas engine in general is destined to be the gainer from the automobilist's struggles with his vaporizers.

Ignition and Ignition Troubles.

By P. M. Heldt.

The electric igniters in actual use on motor vehicle engines may be divided into two classes, viz.: Those in which the make and break of an electric circuit takes place inside the cylinder, and which gives the so-called contact spark, and those in which the make and break of an electric circuit occurs outside the cylinder, and which gives a jump spark inside the cylinder. The former class may again be divided into two sub-classes—igniters in which there is an end contact between electrodes and igniters in which there is a wipe or scrape contact between electrodes.

The simplest form of end contact igniter, and one which was formerly much used with stationary engines, is shown in Fig. 1. A plug screwing into the cylinder head has an insulated bushing, through which passes one of the electrodes. This electrode has a collar, and it is held by a spring against the end of the bushing. The other electrode is a stud screwed into the piston. The two electrodes are in line. Every time the piston comes back the electrodes touch and there would therefore be a spark at every revolution, were it not for a contact maker or switch operated from the crank shaft, which closes at the proper time every second revolution. This form of igniter is ill adapted to small high-speed engines for the reason that the spark passes always a little after dead center, whereas an ignition a little before dead center gives the greatest power. On the other hand, the electrodes are in contact only for a very short time, which prevents the current from attaining its full value and reduces the volume of the spark and the certainty of ignition.

A modification of this igniter is shown in Fig. 2. Here a double-armed lever is interposed between an insulated electrode in the cylinder head and a stud screwed into the piston. Normally the lever is held against the insulated electrode by a spring outside the cylinder, but on the back stroke of the piston the stud in the piston strikes the lever, and brings it out of contact with the insulated electrode in the cylinder head. The spark occurs therefore always a little ahead of the dead

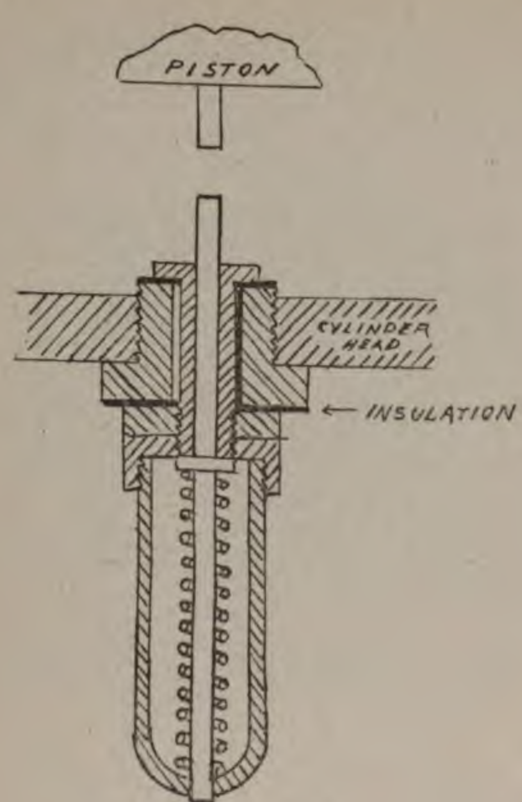


FIG. 1.

center position of the crank. The time of ignition can, to a certain extent, be regulated by advancing or withdrawing the electrode passing through the insulated bushing. In this type of igniter the difficulties of the type illustrated in Fig 1 are overcome. It is, however, not very desirable to have the first ignition occur before the dead center, as the engine is then liable to start backwards.

Any igniter which is actuated by the piston must operate either before or after dead center, as at the dead center the piston is not moving. To overcome this difficulty end-on-contact igniters are now often actuated from mechanism outside the cylinder geared to the crank shaft. Fig. 3 shows one form of igniter in which the electrodes are thus operated. The two electrodes inside the cylinder are held apart by a spring outside the cylinder. One of the electrodes is free to move around a shaft passing through the cylinder or valve chamber wall. On this shaft outside the cylinder there is a pawl which engages with another pawl on the igniter actuating rod. When this rod moves back the pawls engage and the electrodes come in contact. When the pawls disengage or snap the spring on the electrode shaft causes the breaking of the contact and the return of the movable electrode to its original position. With this form of igniter, ignition can be made to occur at any point of the stroke. The electrodes also remain in contact for a sufficient length of time to assure a full strength of current before the circuit is opened. The igniter actuating rod is operated from a secondary shaft, geared to the crank shaft in the ratio of 2 to 1. It may be operated either by a crank, an eccentric or a cam. In the latter case the return of the rod has to be effected by a spring. This form of igniter in its various modified forms is used on a number of marine and motor vehicle engines.

The wipe spark is always more reliable than the end-on spark, but there are certain difficulties in constructing these wipe spark igniters, and they are comparatively little used. It may here be stated that a wipe spark is often claimed when an end contact spark is being had. The wipe spark requires a spring inside the combustion chamber, and it is often thought that steel will not retain its temper when exposed to the heat of the explosion in the cylinder. Fig. 4 shows a wipe spark igniter which with various modifications is used on a number of stationary engines and also on one vehhicle engine of which the writer knows.

As here shown, a blade of spring steel is riveted into a rod and forms one of the electrodes—the insulated one. The pin of a little crank wipes this blade during a part of the revolution of the crank. The blade is deflected by the pin, and when the deflection has about reached its maximum the pin comes to the end of the blade, the blade snaps off from the pin and thus produces the spark. The rubbing of the pin and blade together always keeps the contact surfaces clean. The spring pressure of the blade always produces a sharp break, which is conducive to better results as regards the volume of the spark. The crank is driven through gearing from the cam shaft, and revolves once for every two revolutions of the engine crank. If the engine should start the wrong way through a premature explosion the crank pin would turn up against the blade and might break it. This danger is guarded against by driving through a ratchet. The point of ignition of such igniters may be adjusted on both electrodes. The blades for this igniter should be made of machine steel, and when they are so located that the draft of the incoming charge fans them they will retain sufficient temper to serve the purpose. The writer has found this igniter to be very reliable and efficient, and it is also comparatively simple.

For the insulation of the parts of an igniter either mica or asbestos is used. The former has the best insulating qualities, but many makers prefer asbestos because it does not crumble like mica. The mica, however, only crumbles when used in pieces of very small width. The surface of the insulation inside the cylinder becomes covered with carbon deposit after the engine has been running a while, and the surface of the insulation on the outside is also liable to become dirty. These layers of dirt and carbon cause leakage of the electric current and reduce the volume of the spark. To reduce this leakage the length of the leakage path should be made as long as possible. To this end the diameter of the plug is made larger than the diameter of the flanges of the insulated

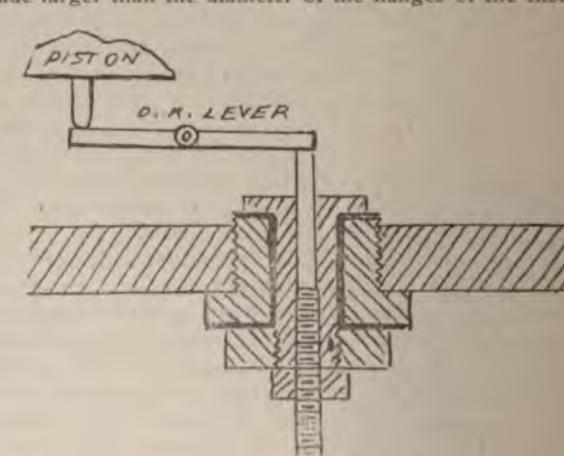
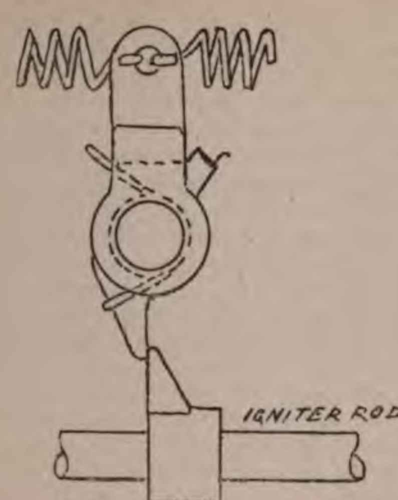


FIG. 2.



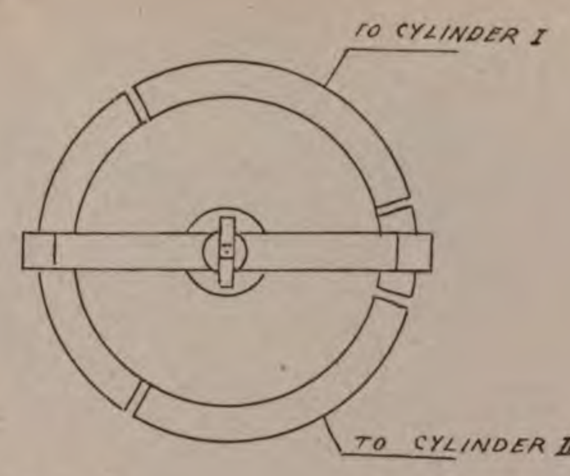


FIG. 3.

bushing and the insulating washers of the same diameter as the plug. This is indicated in Fig. 1.

If the engine is started by a ratchet crank it is quite desirable that the first explosion should not occur before dead center, as otherwise the engine may start in the reverse way, against the exertion of the starter, which may lead to accident. But to obtain the maximum of power from an engine running at high speed it is essential that the spark pass before dead center. The combustion of the explosion mixture begins at the point where the spark passes, and from there spreads to all parts of the combustion chamber. But the propagation of the flame takes some time and the pressure in the cylinder rises therefore gradually and not instantaneously to its maximum value. This is well seen from an indicator card taken from an engine running at high speed. The effect of this lag in the process of combustion is to shift the point of maximum pressure, which in a slow-speed engine lies near the beginning of the stroke, further ahead. It may thus happen that the pressure at the time the exhaust opens is greater than when the piston starts on its forward course. If such be the case, then the ignition should take place at an earlier period to obtain the maximum power. To satisfy the two requirements just mentioned it is necessary to have an adjusting attachment on the igniter, by means of which it can be given a lag when starting and a lead when running at full speed. This adjustment may be effected either by hand or automatically, the latter being the more desirable arrangement.

The writer prefers to locate the igniter in the valve chamber, where the draft of the incoming charge may cool it. This lessens the danger of burning the contact parts and keeps the temper in the spring if there be one inside the combustion chamber. It is sometimes suggested that the explosion might be more instantaneous and more effective if the ignition took lace in the cylinder proper; but if the ports are large, as they should be, there is no loss of power from this source.

The difficulties with igniters are many and the writer has heard the remark that if your gas engine stops the first thing to try is the spark. The faults to which ignition outfits are liable and which will prevent them from working properly are the following: The source of current may run down, the connecting wires may loosen or break at some point, the connecting wires or insulated electrode may ground, the contact of the electrodes may become burned and not permit the passage of the current, the springs may break or become weakened to such a degree as not to produce a good metallic contact. Finally, it may happen that in readjusting the igniter it may be timed wrong.

The running out of the batteries on the road is a source of great difficulty, but this and the remedies therefor have been discussed by the writer in a previous article, and need not here be gone into. Going over to the second of the faults mentioned, it may be stated that it often occurs that a binding screw rattles loose or that a connection wire is broken, the latter being mostly caused by carelessness in work around the engine. The loosening of the binding posts can only be guarded against by seeing to it that they are firmly screwed down when the connections are made. For the connections between batteries, spark coil and engine incandescent lamp cord of one of the larger sizes should be used. The ends fastening to the binding screws should be soldered. The lamp cord consists of a large number of fine wires, is very flexible and not easily damaged.

A ground on the insulated part of the igniter is usually a puzzle for the inexperienced motor operator. When it has been found that no spark passes when the engine is turned over by hand, the following proceeding should be gone through with to locate the difficulty. Turn the crank to a point where the electric circuit should be complete—that is to say, nearly up to the point where the spark should pass. Now detach the wire from the insulated electrode and brush it over this electrode. If there is a spark the batteries, coil and connections are intact and insulated part of the igniter is grounded—i. e., in metallic connection with the engine frame. If, however, there is no spark, then the electric circuit is incomplete and the break should be looked up. The stationary electrode of an igniter should always be the insulated one. Occasionally both electrodes are insulated, and in this case the grounding of one will not interfere with the working of the igniter. It is, however, not advisable to insulate the movable electrode, as the pressure and strain due to the power applied to it would soon throw it out of line and eventually short circuit it. The igniter springs must always be kept in good condition, especially in such igniters where the pressure of contact depends upon the force of these springs. Coming now to the last named source of trouble, the improper timing of the igniter, it may be that the mentioning of the possibility of such an occurrence provokes a smile upon the counte-

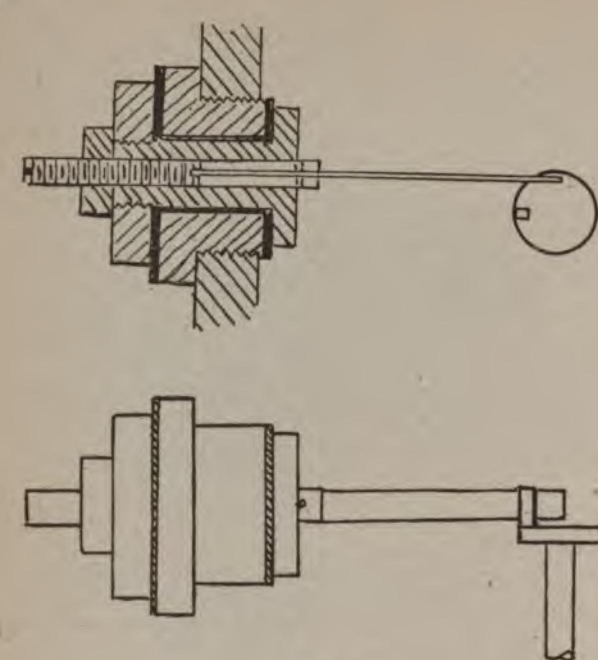


FIG. 4.

nance of some reader, as even the novice knows that a proper timing of valves and igniters is necessary to secure good results with an explosive motor. The writer would not have mentioned this subject were it not for the fact that he has actual knowledge of cases in which days of time of people who claimed to be more than mere amateurs were wasted simply because in reassembling an engine they had meshed the valve operating gears incorrectly. Such a mistake as this should ordinarily be easily discovered; but when, as in one of the cases above referred to, some other changes or additions are made at the same time the valve operating gears are dismounted and reassembled, the cause of the difficulty is likely to be assigned to these new parts.

It is always well to have a plug directly over or at least somewhere near the place where the spark occurs, so that, when withdrawing this plug and turning the engine by hand, the spark may be observed. In larger engines a plug with a small mica window is sometimes placed directly over the igniter, thus permitting the spark to be observed while the engine is in motion and without removing the plug; but it is hard to find room for such a device in a small engine.

The negative electrode of an igniter is not affected nearly as much by the action of the spark as is the positive electrode, and in connecting up an engine the electrode which is easiest replaced should therefore be made the positive one. If primary cells are used for ignition the positive terminal is the one connected to the carbon plate.

The igniter circuit should be provided with a hand switch so located that the circuit may be opened and closed by the driver from the seat. If the engine is of the multiple-cylinder type this switch should preferably be made so that any one and all of the igniters can be switched in at will, which greatly facilitates the testing of the cylinders. Fig. 5 shows a form of switch for a double-cylinder engine which will permit these various connections. If the switch lever is held down by a shoulder screw with a butterfly head it may easily be withdrawn when having the wagon stand in the street, and thus protect it against mischievous designs.

The jump spark, which is very much used in France, has not as yet become very popular in this country. The objection usually made to it is due to the difficulty of insulating against the high pressure necessary to produce a spark between terminals 1-16 in. or so apart. The outfit is also considerably more expensive than the simpler forms of contact spark igniters. Jump spark igniters require a coil with two windings, called an induction coil. One of these windings, called the primary, consists of large wire and few turns, and the other, called the secondary, consists of a very large number of turns of very fine wire. There is no electrical connection between the two windings. The current from the primary battery or other source of current supply is sent through the primary winding and interrupted at the proper moment by a switch or commutator driven from the crank shaft. When the circuit is broken the current suddenly ceases in the primary, which by inductive action produces an electro-motive impulse in the secondary winding. The terminals of the secondary winding are connected to the electrodes of the igniter. The electrodes of a jump spark igniter are sometimes both insulated, while again one is grounded. The insulated electrode or electrodes pass through a bushing of insulating material, held in a metal plug screwing into the wall of the combustion chamber. The electrodes have platinum points and they are bent so as to come very close to each other. The electro-motive impulse in the secondary coil will send a spark across the gap intervening between the two electrodes, and this spark ignites the mixture.

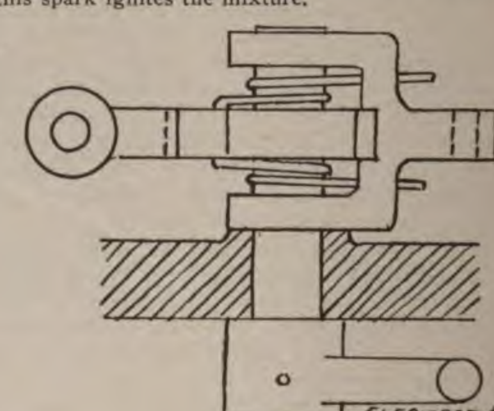


FIG. 5.

Where the engine has a single cylinder only the current has to be sent through the primary coil once for every two revolutions of the engine; where a double cylinder twice, and where a triple cylinder three times. These current impulses must of course be spaced the same as the explosions. For a multi-cylinder engine we also need a commutator, by means of which the spark can be distributed to the various cylinders. The adjustment for timing the spark of a jump spark igniter must be made on the commutator making and breaking the primary circuit, and consists in giving an angular motion to the stationary part of the commutator.

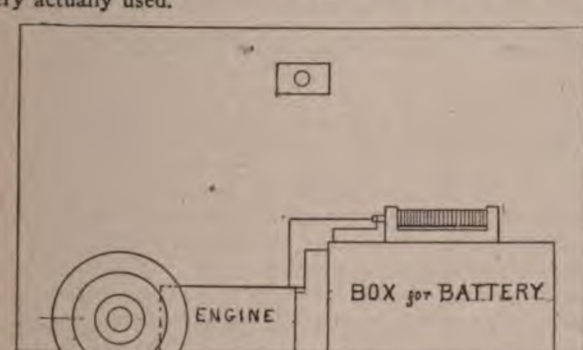
Coils and Sparks.

By E. J. Stoddard.

THE PROBLEM STATED.

In Fig. 1 A the lighting apparatus and engine are shown in what may very well be their relative sizes.

If the energy developed by the engine is represented by the parallelogram forming the border of the figure, then the small parallelogram at the top and center will represent the capability of the batteries for producing energy and the area of the small circle will represent that part of the power of the battery actually used.



— FIG. 1..A

When we recollect that the science of electricity boasts of affording the most economical means for the transformation of energy, the state of things represented in the figure seems to present a direct challenge to our engineers and inventors.

I propose to very briefly outline a theory of the sparking coil. Much must be omitted to economize space.

Approximations only are attempted.

What I wish to do is to get at the philosophy of the matter.

Not only are our battery power, economy of space and conveniency involved, but the working of the engine seems to depend somewhat on the quality of the spark. A good igniting spark may make possible a form of engine that would be impossible without it.

In reference to the subject of this article, I have felt the need of a working theory that should instruct my observation and point out the road of progress, but have not found it. For want of a better instructed workman, I shall attempt to outline such a theory. Possibly in instructing myself I may pursue a better path for the instruction of others than one more expert in this line.

THE "JUMP SPARK."

I have thought, with a number who speak as having authority, that the Ruhmkorff coil was only adapted to experimental work. I have found it extremely difficult to keep the secondary current in its proper path, and the proper adjustment of the vibrator has seemed to be largely a matter of luck; besides, this coil is liable to a fatal disease, called the "breaking down" of its internal insulation.

In one case a short circuit was formed by deposit upon the mica insulation. We had the mica washed carefully in potash and water. On again trying it we found it as bad as ever. We then washed it in alcohol and then found it temporarily in working order.

The presence of gasoline vapor seems to increase the resistance to the passage of the spark.

If such a high tension current is to be used at all, in view of the modern improvements in static machines it would seem promising to return to that early method of ignition.

SELF INDUCTION SPARK.

If a current is sent through an ordinary "sparking coil" when the circuit is broken a spark, or arc, is formed at the break by the self induction of the coil.

If with such an apparatus one makes the contact and break by a straight spring held in the hand and gradually shortens the spring, he will get a sharper and sharper break and will find that the spark improves until the spring is quite short, when it again deteriorates.

With practical apparatus I have always found that the sharper the break the better the spark. With the coils I have used a blow is better than the action of a spring.

With high speed engines small intervals of time become material. Therefore it is important to see that the contact is long enough to allow the current to be fully established before the break occurs. I have seen a good many failures due to a neglect of this precaution. With a particular coil we put an adjustable contact upon a high-speed lathe and gradually diminished the time of contact. With a contact of 1-40 of a second or less the spark seemed to fall off considerably—so much so that ignition would have been uncertain.

The spark, or arc, is usually formed between platinum surfaces. It would seem probable that the material of the ordinary arc light carbon might be a proper substitute.

COIL CALCULATIONS.

The coils are wound around a bundle of soft iron wire. We may approximate the intensity of the exciting field, H, in lines per square centimeter by multiplying the ampere turns by the constant 1.257 and dividing by the length of the coil in centimeters.—Thompson's Elements, Sec. 342.

If the magnetic circuit were complete, we could calculate the "flux density," B, through the iron by simply multiplying H by the permeability of soft iron.

$$(1)\ B = W\ H$$

and we might construct a curve (A B, Fig. 2) with H as abscissas and B as ordinates.—Thompson's Elements, Sec. 364.

But we know that the actual conditions vary a great deal from those of the complete magnetic circuit.

We find a method of approximating the true curve in Dr. Du Bois' work on the "Magnetic Circuit," translated by Atkinson; Longmans & Co. See also Ewing, "Magnetic Induction in Iron," etc.

Following the instructions there given, we lay off a straight line, A C, from A, whose equation is

$$(2)\ x = - N\ B,$$

in which N is a constant depending upon the ratio of the diameter to the length of the coil.

The following are some of the values of N, given by the authority last quoted, for different ratios, m, of diameter to length.

The values actually given in the book have been multiplied by $\frac{1}{4\pi}$ to adapt them to more familiar units.

m.	N.	m.	N.
10	.0172	30	.00313
15	.0095	40	.0019
20	.00617	50	.00129
25	.00424		

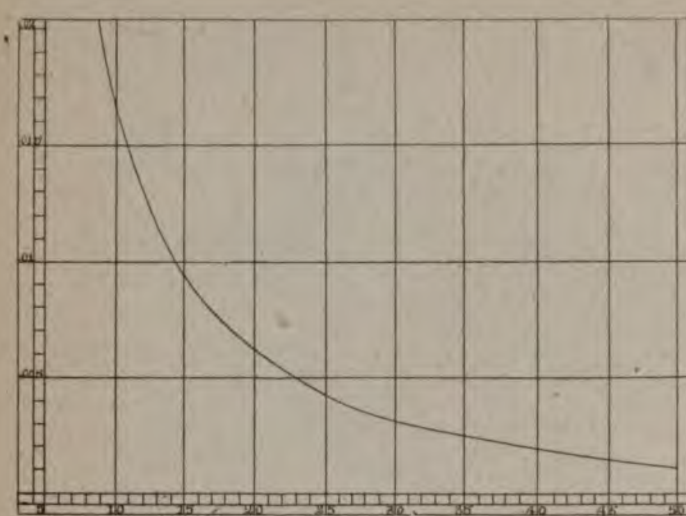


FIG. 1

In Fig. 1 we have constructed a curve with N as ordinates and m as abscissas. This curve will serve to estimate values not given in the table.

We now "shear" the curve A B (Fig. 2) to the right by adding the abscissas of the line A C to the corresponding abscissas of the curve A B (that is, abscissas having equal ordinates are added). This gives us the approximately straight line A D, which we take for the actual curve of magnetization of the iron core.

The inductance (coefficient of self-induction) of the coil will be

$$(3)\quad L = B\,A\,S\,10 - 8 \text{ or } \frac{B\,A\,S}{100{,}000{,}000} \text{ henries.}$$

in which B is the number of lines per square centimeter of cross section of the core when a current of one ampere is flowing; A is the area of the cross section in square centimeters and S is the number of coils.

Helmholtz's Equation ("Thompson Elements," Sec. 460) is as follows:

$$(4)\quad C = \frac{E}{R}\left(1 - \frac{1}{2.71828\,\frac{Rt}{L}}\right)$$

in which C is the current in amperes, E the pressure in volts, R the resistance in ohms, t the time in seconds and L the inductance in henries.

This formula seems a little complicated, but is really not very difficult to work.

Mr. Alfred Hay in his little book on "Alternate Current Working" gives a simple graphical construction covering the same ground as formula 4, which method depends upon the fact that the rate of change of the current is proportional to the abscissas of a straight line whose inclination is $\frac{L}{R}$ (the time constant).

These two methods may be used to check each other, and each has its individual utility.

AN EXAMPLE.

I find that one gets a more realistic conception of principles and quantities by considering a concrete example. I have therefore eviscerated my coil in order to get its measurements. I find that the core is about 1 in. in diameter and 9 in. long. The area of its cross section would therefore be about 4.6 sq. cm. There are about 428 turns of No. 14 wire (about 200 ft.), having a resistance of, say, .5 ohm. Suppose we use six cells of an Edison-Lalande battery in series having an electro motive force of 4 volts and an internal resistance of, say, .2 ohm, so that the total resistance of the circuit is about .7 ohm. The current would be $\frac{4}{.7} = 5.7$ amperes. The intensity of the field due to the coil would be

$$H = \frac{1.254\,(5.7)\,428}{22.86} = 134$$

To get the actual magnetic flux, we will "shear" the line A B (Fig. 2) to the right, as above indicated.

Referring to the table and diagram Fig. 1. we find that N (formula No. 2) is about .019 for a ratio (m) of diameter to length, of 1 to 9. Substituting this value in .2, and laying off

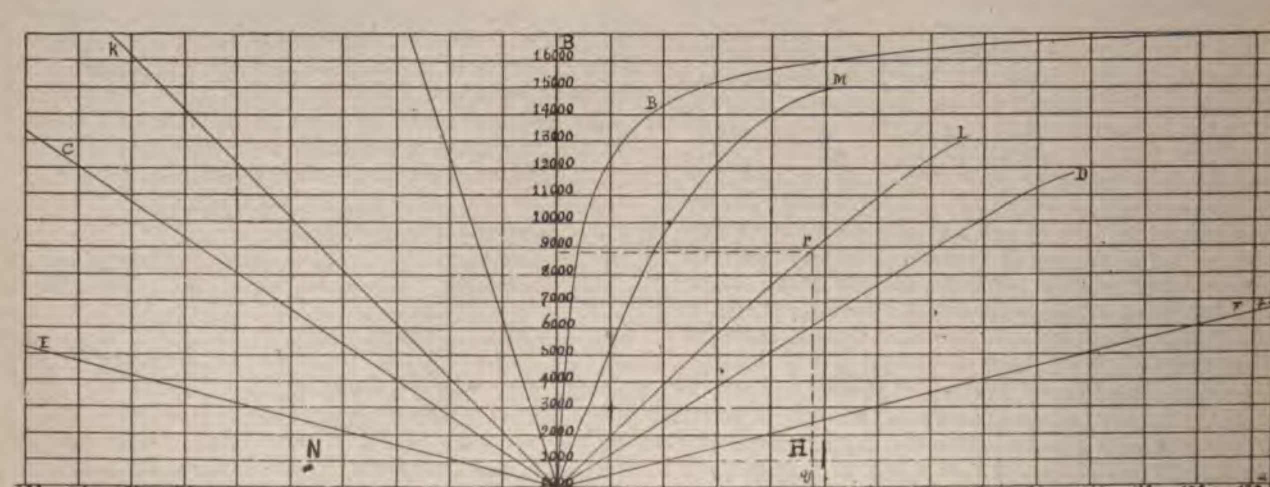


FIG. 2.

the corresponding line, we get the line A E, Fig. 2. Adding the abscissas of the line A E to those of A B gives us the line A F as the curve of magnetization of the coil.

With a value of 134 for H, we find that the flux in the iron core represented by the ordinate a b is 6,900 lines per square centimeter of cross section, or 6,900 × 4.6 = 31,740 lines for the total flux.

For an increase of 1 ampere in the current the increase of magnetic flux is about $\frac{31740}{5.7} = 5570$. The inductance by formula 3 is

$$L = \frac{5570 \times 428}{100,000,000} = .024 \text{ henries.}$$

We are now in position to calculate the time necessary to establish a current in the coil.

TIME CURVE.

We will construct a curve in which the time in fractions of a second are abscissas and the current in amperes are ordinates, by the simple method given by Mr. Hay.

We first draw a horizontal line, A B, Fig. 3, across the paper at the bottom. Near the center of the paper we draw the vertical line C D. We lay off the time in .01 second to a convenient scale to the right from the intersection of A B and C D. On C D we lay off the amperes to a convenient scale and divide it into spaces representing half amperes. We locate the point D, representing our maximum current $\frac{E}{R} = \frac{4}{.7}$ or 5.7 amperes.

We now lay off to the left from the intersection of the lines A B and C D, to a convenient scale, a value equal to the electro motive force divided by the self induction, $\frac{E}{L} = \frac{4}{.024} = 167$. This gives us the point A. Connect A and D by a straight line. Now the abscissas of the line A D are always equal to the rate at which the current is increasing at different values of the current.

For instance, at the commencement the current is increasing at the rate of 167 amperes per second, and when a current of ½ ampere has been established the current is increasing at a rate represented by the line c d = 153 amperes per second. The average rate of increase is represented by the line a b half way between the other lines = 161 (about) amperes per second. If the current is increasing at the rate of 161 amperes per second it will take it 1-161 × ½ = 1-322 = .0031 second to attain to the value of ½ ampere. Laying this value off on C B and drawing a vertical line through the point thus found to meet the horizontal line through the ½-ampere point, we get the first point, F, of the required curve.

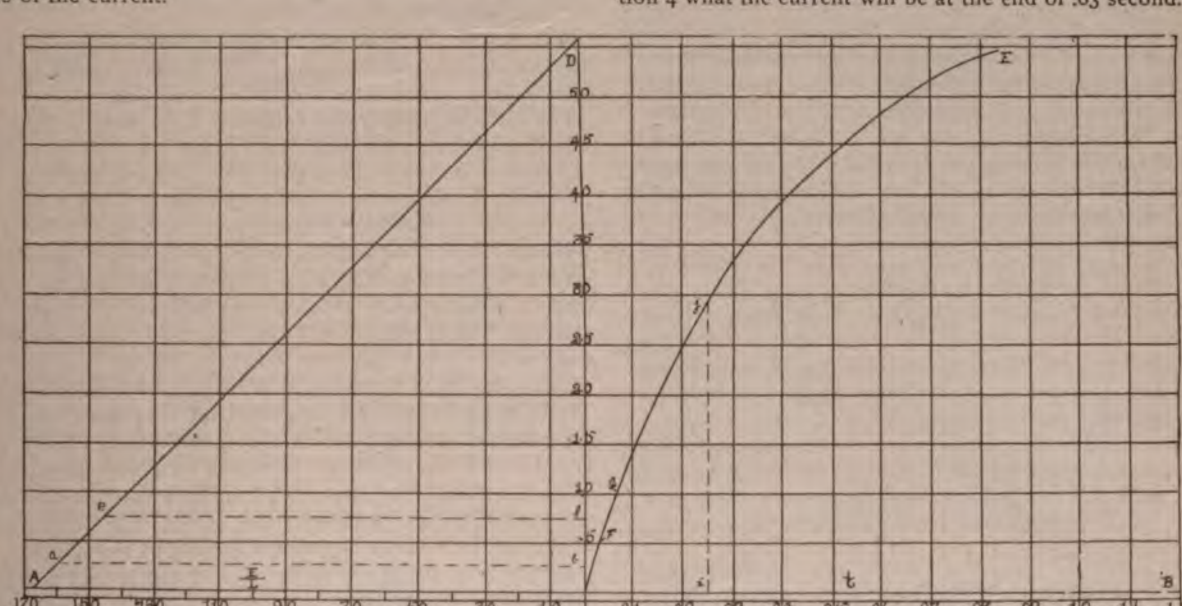
In the same way we find that the line e f = 145 represents the average rate at which the current is increasing from a value of .5 to 1 ampere. The time occupied in this increase is therefore 1-145 × ½ = 1-290 = .0034 second. The time occupied in increasing from 0 to 1 ampere is therefore .0031 + .0034 = .0065 second. Laying this value off as before, we find for the intersection of the vertical line through that point and the horizontal line through the 1-ampere point the second point, G, of the curve.

Continuing in this way we get the following values:

Time Increasing from Zero.	Value of Current Ampere.	Time Occupied in Increasing .5 am.
.0031	.5	.0031
.0065	1.0	.0034
.0104	1.5	.0039
.01475	2.0	.00435
.01975	2.5	.005
.025663	3.0	.00588
.03273	3.5	.0071
.0418	4.0	.0091
.0523	4.5	.0105
.0648	5.0	.0125
.10848	5.5	.02

Which being platted as above described gives us the curve C F G E.

To test the accuracy of our work let us calculate by equation 4 what the current will be at the end of .03 second.



—FIG. 3—

C = current.
E = electro motive force = 4 volts.
R = resistance = .7 ohm.
L = inductance = .024 henries.
t = time in seconds = .03.

$$C = 5.7\left(1 - \frac{1}{2.718^{.87}}\right)$$

$$C = 5.7\left(1 - \frac{1}{2.387}\right)$$

$$C = 5.7\left(\frac{1.387}{2.387}\right) = 3.31 \text{ amperes.}$$

Drawing the ordinate g h through the point .03 second to meet the curve C E, we see that the point of intersection corresponds to about 3.5 amperes. The discrepancy represents inaccuracy in the work. Possibly we should have divided the vertical line into parts representing ¼ amperes. The finer that is divided the more accurate is the work. However, it is sufficiently accurate for all practical purposes.

PRACTICAL DEDUCTIONS.

Suppose we have an engine turning 600 revolutions per minute, or 10 per second. If we make a contact for one-quarter of a revolution its duration will be 1-40 of a second, or .025. In Fig. 3, if we draw an ordinate, i j, through the point .025, cutting the line C E at j, we see from the position of the latter point that we only get about 2.9 amperes through the coil. It would have been better to use four instead of six cells of battery and given it a longer contact.

The curve C E bends over a good deal at the top. That is, while the current passing at this point is greatest, the increase of current and consequently of magnetic flux is small. A longer contact than necessary simply wastes our battery without an adequate effect. With the apparatus giving the curve of Fig. 3 a contact of .08 would seem to be sufficient. That is, the contact should last for about .8 of a revolution. At this point there would be something less than 5.5 amperes flowing through the coil.

THE BREAK.

It has been noted as a matter of fact that the sharpness of the break seems to have a good deal of effect. It is generally considered that we require a pressure of 50 volts for an arc—that is, we must diminish the magnetic flux at the rate of 50×10^8 lines per second. In our coil we have, say, 30,000 lines flowing through 428 coils. The time occupied in breaking the circuit must therefore be as short as

$$\frac{428 \times 30000}{50 \times 108} = \frac{428 \times 3}{50 \times 104} = \frac{1284.}{.50\ 0000} = .002568 \text{ seconds.}$$

That the contact pieces have to move some distance before the current is broken seems certain; how far I do not know. We may perhaps conclude that it takes a special effort to separate the points in such an apparatus as we have described so as to get the break in .0025 second.

If the moving part weighed 1 lb. it would require a pressure of about 100 lbs. to move it .01 ft. in .0025 second, or about 50 lbs. to move it 1-16 in. in that time, and 25 to move it 1-32 in., and so on, the distance moved in the given time being proportional to the force exerted.

THE COIL.

It is not only necessary that the break should be sharp, but there must be little magnetism remaining in the core after the current has ceased. This is the reason that a straight bar is used instead of a complete magnetic circuit. On looking at Fig. 1, it will be seen that the value of N diminishes as the ratio of the diameter to the length of the coil decreases—that is, the magnetic circuit becomes less and less imperfect. Upon this point Dr. Du Bois says, page 276:

"From the purely magnetic point of view there would scarcely be any object in making the dimension ratio of the core less than 45, and thereby needlessly increasing the demagnetizing action."

Of course, the longer we make the coil the heavier it is, and the more room it will occupy. However, its shape is such that it may be readily stowed away.

The steepness of the line at the left of Fig. 1 would seem to indicate that it would be well to make the core 20 or 25 diameters in length. Let us do this, retaining the same windings as before. We will make it 25 diameters long.

The increase in weight would be about $.7854 \times 16 \times .26 =$ 3.27 lbs.

The value of N, taken from the table, is .00424. With this value of N, substitute in equation 2, we lay off the line A R in the same way that we laid off A C and A E. Shearing the line A B to the right as before, we get the line A L as the line of magnetism of our proposed coil.

As we have lengthened out our coil $\frac{25}{9} = 2.78$ times the value of H will be proportionally less, or $\frac{134}{2.78} =$ about 48.

Erecting the perpendicular q r to meet the line A L at r, we see that the point of contact corresponds to a magnetic flux of about 8,900 lines per square centimeter—that is, by increasing the length of the coil we have increased our effect with the same expenditure in the ratio $\frac{8900}{6900} =$ about 1.29.

We have increased the weight of our coil 3.27 lbs., but we can evidently dispense with at least one of our battery cells and get the same or a better effect than before. This would be a net saving in weight and space.

We need not be as careful with a long as a short coil about the sharpness of the "break." On the other hand, we must have a longer contact to establish the current.

For instance, suppose we substitute $L = .024 \times 1.29 =$ say .031, and $t = .08$. In equation 4 we have

$$C = 5.7\left(1 - \frac{1}{2.71828^{1.808}}\right) = 5.7\left(1 - \frac{1}{6.1}\right) = 4.7 \text{ amperes.}$$

Whereas before we had a current of about 5.4 amperes with that length of contact. However, a difference in the time of contact between .08 and .1 or .125 is not generally very material, though it may become so in very fast running engines.

It will be noticed that while in lengthening out the coil we have obtained a net gain in power, we have done this at the expense of inserting more iron and diminishing the value of H for our battery power. It would seem well to inquire if it is not possible to get the advantages without the disadvantages. In this, regarding the "Hedgehog Transformer" of Mr. James Swinburne is suggestive. In this the wires of the core protrude from each end and are spread apart like the bristles of a brush or are bent back upon the coil, thus reducing the resistance of the magnetic circuit. It would seem probable that we could reduce the magnetic circuit as

far as we wish in this way without greatly increasing the amount of iron or length of the coil. The best construction could only be found by experiment.

As Dr. Du Bois says that there is no use of diminishing the length of the core to less than 45 diameters, let us draw the line of magnetization for a coil having a core of that dimension and assume that we attain that curve with a core 9 diameters long. A M is the required curve of magnetization. We do not want to carry the magnetization beyond the elbow of the curve; therefore let us dispense with all but one of our cells.

We would then have a pressure of .7 volt resistance of about $.033 + .5 = .533$ ohm and a maximum current of $\frac{.7}{.533} = 1.31$ amperes. The maximum value of H would be

$$\frac{1.257 \times 1.31 \times 428}{22\ 86} = 30.8$$

which would give us a magnetization of something over 12,300, or $\frac{12300}{6900} = 1.78$ times that which we got with the six cells before.

The inductance would now be much greater, and it might be better to use two cells, so that the contact could be shorter.

There are those who prefer to use a secondary coil and a "jump spark"; others prefer the self-induction coil with an arc. It would seem well to inquire if a combination of the two systems would not be advantageous.

Suppose, for instance, we break the primary outside of the cylinder, and break the secondary inside the cylinder, so as to form an arc there just as we did before with the primary. Our secondary coil need not have a great many turns, as we only want 50 volts, and the primary break may be made under oil. We may now use a condenser so as to get a return current.

Dr. Du Bois intimates that in this case we may use a complete magnetic circuit. If this is so we may expect to again multiply our effect from a given battery by 4 or 5.

Thus, theory would seem to indicate that we may hope to improve our igniting apparatus by something like 2,500 per cent. by alterations in the coil.

THE BATTERY.

The advertising columns of The Horseless Age indicate a recognized demand for a battery adapted to this purpose. The advantages of the "Edison-Lalande" are that it is constant with a closed circuit and has a small internal resistance.

The dry battery presents obvious advantages. I have seen a dry battery give out 18 amperes on a short circuit. In the matter of dry batteries the fakir has got in his deadly work and a really meritorious battery will have to overcome public distrust. It would seem as if for our use the polarizing tendency of the "open circuit" batteries might be overcome.

The necessary time of contact would seem to promise to be a material obstruction to progress. If this shall prove so, a larger internal resistance to the battery may not be very objectionable, as it tends to shorten the necessary time of contact.

The coil and battery should be adapted to each other.

The Vibration of Explosion Motors.

By Herbert L. Towle.

The forces which may produce vibration in a gas engine are of three kinds, viz.: The centrifugal force of unbalanced revolving parts, the inertia of unbalanced reciprocating parts, and the varying torque applied by the explosions to the crank shaft. The first two of these are due simply to the movement of the parts, and would be the same if the engine were run by outside power with all valves open. The third force—the torque—causes vibration from the fact that the explosion impulse tends to rotate the engine and shaft in opposite directions. The turning moment is the same against each, but the engine frame yields to it less because it is heavier and is bolted to a heavy frame. As this yield is intermittent with the explosions, it becomes an important part of the total vibration.

Centrifugal force is so familiar a thing that little need be said of it here. It may be calculated by the formula

$$F_c = \frac{W V^2}{g r}$$

in which

F_c = centrifugal force in pounds.
W = weight of revolving body in pounds.
V = velocity of same in feet per second.
g = acceleration of falling body, = 32.2 ft. per second.
r = radius of revolution in feet.

In applying the formula the body must be imagined as concentrated at its center of gravity. The velocity V must be the linear velocity of this point, and the radius r must be measured to it likewise. In the case of an engine it is usual to neglect that half of the crank shaft next to the shaft center as practically balancing itself, and for the remaining parts to reckon the radius of the crank pin center. The connecting rod should be weighed with its two ends on separate scales, and the resulting weights assigned to the revolving and reciprocating parts respectively; or these weights should be calculated as nearly as possible when designing the engine. With the centrifugal force of the cranks, pin and crank end of rod thus known, an approximate calculation may be made for the size of the balance weights. It is better to have the latter a little too heavy than a little too light, as in the former case the excess will help to balance the inertia of the piston, merely introducing a corresponding lateral vibration. To what extent this should be done will depend on the position of the motor. In general, vertical vibrations are the ones most to be avoided in carriage work, and the balance weights should be so designed as to reduce these to the minimum, even if longitudinal or transverse vibrations are thereby increased.

One feature of common practice is to be followed with caution, namely, the custom of regarding the opposite cranks of cylinders some distance apart, or the triple cranks of a three-cylinder marine type of engine, as balancing each other without the use of weights. They do balance when the engine is at rest, but when it is running each pair of cranks exerts an outward pull in its own plane of rotation, and the result is a slowing tendency which in the lighter classes of vehicles may be very objectionable. Of course, the nearer the cylinder axes approach each other, the less will be the vibration from this source; and for practical purposes the opposite-cylinder, opposite-crank type of engine, so popular

for vehicle work, may be considered as in perfect mechanical balance.

Perhaps the simplest way of looking at the piston inertia is to remember that it is balanced (neglecting the angularity of the connecting rod) by the parallel or axial component of the centrifugal force exerted by an equal weight opposite the crank pin at the same radius. In other words, putting F for the piston's inertia force, Fo for the centrifugal force of an equal weight at the crank radius, and w for the crank angle 1, which represents a piston and crank with Scotch yoke or slotted crosshead connection, if the weight of W equals that of measured from the dead center, $F = F_o \cos. w$. Thus in Fig. the reciprocating parts, and O P represents its centrifugal force, then $O\ Q = O\ P \cos. w =$ inertia force of the reciprocating parts.

It must be remembered, however, that F owes its existence not to the velocity of the reciprocating parts as such, but to the rate of change of that velocity; and the fact that F is greatest at the ends of the stroke is due to the fact that the piston's velocity changes most rapidly when it is moving most slowly. This will be understood from an inspection of Fig. 2. In this diagram M N is the cylinder axis, and the crank pin at A has traversed the arc E A from the dead center. If we neglect the influence of the connecting rod, then while the crank pin has traveled through E A the piston has moved a distance equal to E D; and similarly for any other arc, the simultaneous travel of the piston will equal the projection of that arc on the base line M N. If now we suppose the crank pin, instead of following the circle, to move off (still at its own uniform velocity) tangentially along the line A B, then for any distance A B of the crank pin's motion the piston's travel will still be the projection of A B upon M N or upon a line parallel to it. In the diagram this projection is A C. If A B be taken to represent by its magnitude the velocity of the pin, then A C represents the velocity of the piston for the same period, or

$$\frac{\text{vel. of crank pin}}{\text{vel. of piston}} = \frac{AC}{AB}$$

and this ratio holds true even if A B and A C are drawn infinitely short. But, by the properties of similar triangles, the angle A B C = the angle A O D, their corresponding sides being perpendicular. Consequently

$$\frac{AC}{AB} = \frac{AD}{AO}$$

which is the sine of the crank angle A O D. The sine of the crank angle at any instant, therefore, represents the piston's velocity relative to that of the crank pin at the same instant; and it may readily be seen from the figure, what is familiar in trigonometry, that the value of A D increases or decreases much more rapidly near the centers than near mid-stroke.

Now it may be shown that the rate at which A D (or $\frac{AD}{DO}$) is in process of changing, at any position of A, is proportional to $\frac{DO}{AO}$, which is the cosine of the same crank angle; and this cosine is therefore the measure of the inertia force. When the crank is on the center $w = 0°$, and $\cos. w = 1$; and in this position the inertia of the piston, acting in line with the crank, is exactly what the centrifugal force would be if the piston were attached to the crank pin itself; or $F = F_o$. This is its maximum value; and, as just noted, its value for other

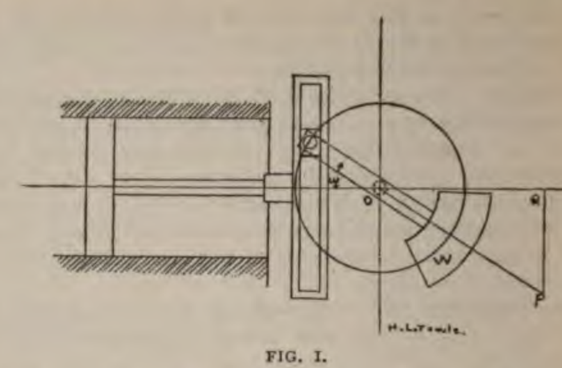


FIG. 1.

positions of the crank becomes the product of F_o into the cosine of w.

For engines with Scotch yoke connection this formula is correct and sufficient; but where a connecting rod is used its effect is to quicken the piston's motion in the first half of its out stroke and retard it in the latter half, and vice versa. The result is to make the inertia force dependent somewhat on the relative length of the connecting rod, and the formula, which need not be derived here, is

$$F = F_o \left(\cos w + \frac{r}{l} \cos 2\,w\right)$$

where

$$\frac{r}{l} = \frac{\text{radius of crank}}{\text{length of rod}}.$$

The influence of the connecting rod is often neglected, but in certain cases it may impair the balance considerably. Take for instance the twin-cylinder marine type of engine, with cranks 180 deg. apart. Here one piston is at the bottom of its stroke when the other is at the top, and in that position $w = 0°$, or 180 deg., and $\cos. w = 1$ for the top piston and -1 for the bottom one. If

$$\frac{r}{l} = \tfrac{1}{4},$$

we have $F = F_o (1 + \tfrac{1}{4}) = 1.25\ F_o$ for one piston, and

$$F = F_o (-1 + \tfrac{1}{4}) = -.75\ F_o$$

for the other; the negative sign showing that the force is ex-

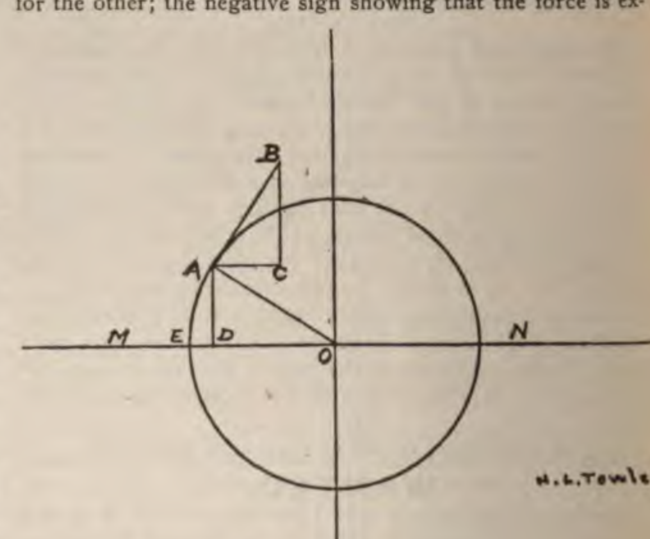


Fig. 2.

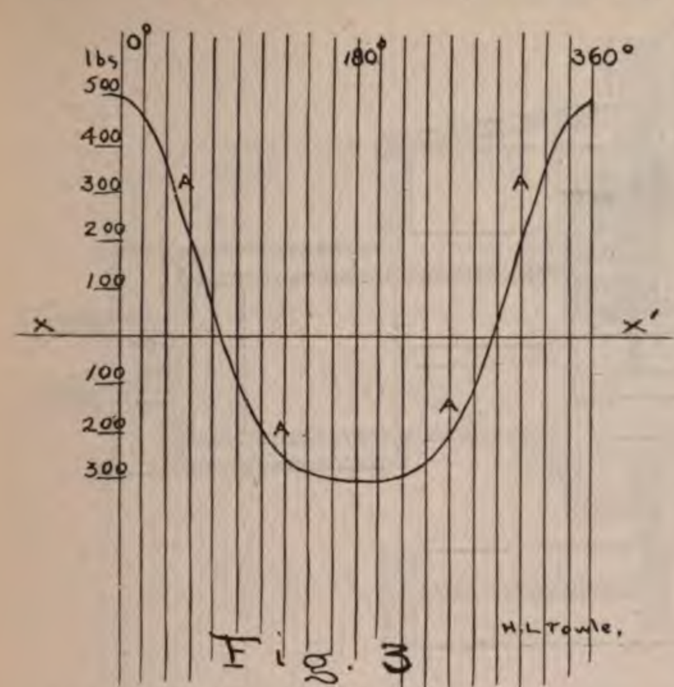


Fig. 3

erted downward instead of upward. There is consequently an unbalanced upward force of 0.5 F_0 occurring twice every revolution. Again, at mid-stroke cos. $w = O$ for both pistons, and cos $2\ w = -1$, so that we have $F = F_0\ (O - \frac{1}{2})$ for each piston, or a downward force of $-$ 0.5 F_0 for both. Where reliable results are aimed at, therefore, the completer formula should always be the one used.

As an example of the formula's application, let us assume a cylinder of 5 in. bore by 6 in. stroke, with r.p.m. = 600, and w = 13 lbs. for piston, wrist pin and end of rod. Then $V^2 = (2\ \pi\ r \times 600 \div 60)^2 = 246.74$ ft. per second, and $F_0 = 398.5$ or practically 400 lbs. If $\frac{r}{l} = \frac{1}{4}$, the values of F at the ends of the stroke, are 500 and 300 lbs. respectively. In Fig 3 are plotted its intermediate values for a complete revolution. Here the base line X X' is divided for each 18 deg. of crank angle, and F is measured vertically from X X' to the curve A A.

If we wish, we can divide the several values of F by the area of the piston—in this case 19.64 sq. in.—to reduce them to pounds per sq. in. We may then plot them on the indicator card of our engine, and thus ascertain the net effective force which impels the piston. In Fig. 4 the line A A' is such a curve of inertia force, and B B is the curve of net pressures. As the pressure of the explosion is downward, while the inertia force at the top of the stroke is upward, it is necessary to plot the positive values of F below the base line, and the negative values above.

The maximum inertia force in one cylinder should never exceed the compression, even in a balanced engine, because if it does, and if there is any lost motion in the wrist or crank pin bearings, the explosion will cause a destructive knock. In a properly designed Otto cycle engine the net pressure on the piston is continuously toward the shaft from a point about midway of the suction stroke to about midway of the exhaust, where the inertia force changes in sign.

What was said above concerning the slewing tendency exerted by cranks revolving opposite but in different planes applies in substance also to the reciprocating parts. As the inertia forces act only along the cylinder axes, however, the result will be (when the axes are parallel) a rocking rather than a slewing. Usually the forces composing the "rocking couple," as it is called, are nearly equal; and in this case the moment of the couple is equal to the product of the sum of the forces—or of their parallel and opposite components—into half the shortest distance between them. For example, let us take the twin-cylinder marine type of engine described in connection with Fig. 3, and let us suppose that the distance between centers of the cylinders is 6 in. In this case we may without serious error assume that $F = F^o$ cos. w = 400 at each end of the stroke, which brings the neutral point midway between the cylinders. As 400 is the value for each cylinder, we have $2 \times 400 \times 6 \div 2 = 2{,}400$ inch-pounds for the rocking couple, applied and reversed every revolution. This is its maximum value, and the mean will be about 0.78 of this, or about 1,900 inch-pounds. As the latter is equivalent to the weight of a heavy man, applied at the end of a 10-in. lever, it will readily be seen that it needs only a favorable opportunity to make trouble.

Such an opportunity is given when the arrangement of springs and the location of the motor are such that the period of vibration of the carriage body corresponds to the revolution time of the motor. The carriage may be regarded as an elastic unit, which will vibrate in any given plane some definite number of times per second, and with greater intensity or rapidity in some planes than in others. If, therefore, the revolution time of the motor approaches the vibration period of the carriage in any plane, and especially if the principal planes of vibration of the motor and carriage coincide, the resulting "sympathetic" or synchronous vibrations of the carriage will have an intensity far in excess of the effect

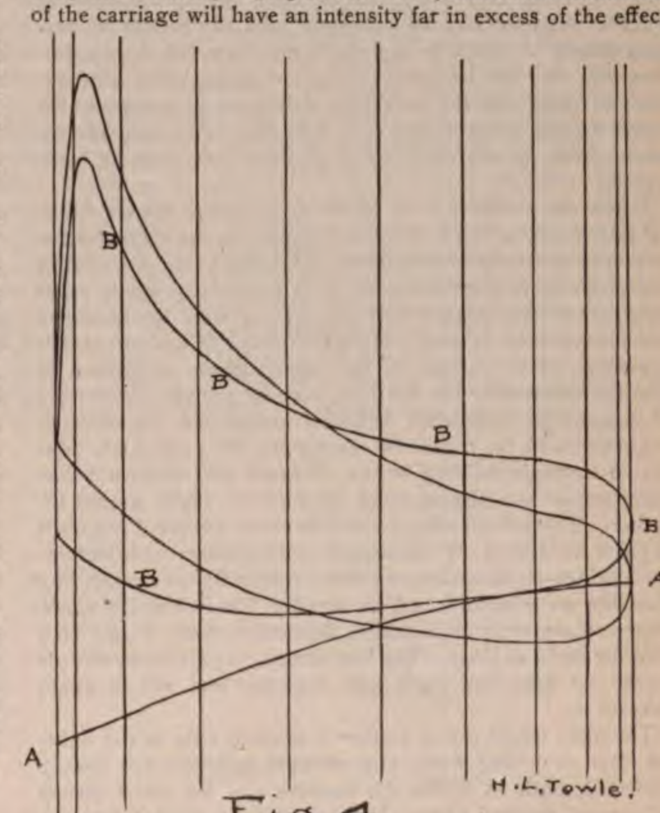


Fig. 4

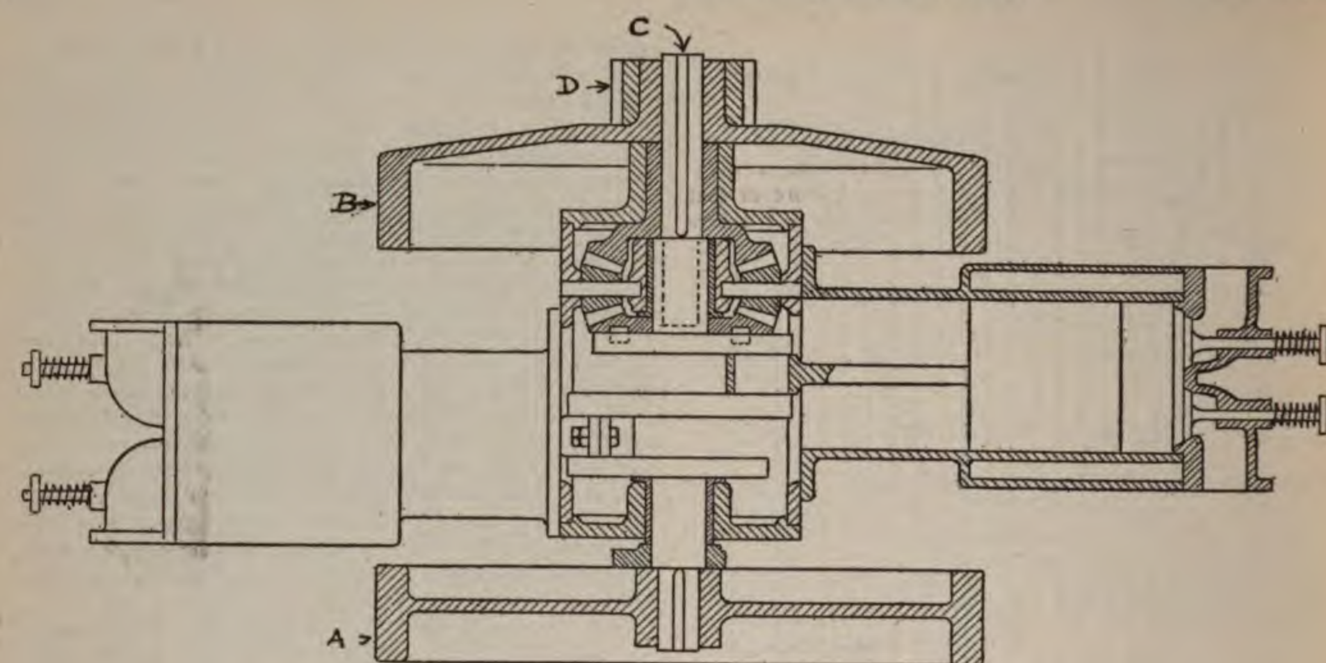


FIG. 5.

of any single impulse. With so complex a system of springs as a carriage presents, preliminary calculations would be practically useless, and the wisest method is to arrange the motor with its principal plane of vibration in the direction where the least vibration in the carriage is to be expected, and then be guided by experiment as to the proper speed.

The above principles cover every form of mechanical vibration ordinarily met with, and by their application existing types of engines may be compared and the merits of new ones tested. Applied to engines of one, two and three cylinders, etc., they will be found to indicate the preferred arrangement of parts and the particular treatment of design which (other things being equal) will give the best attainable results. Some of the more usual of these may here be mentioned.

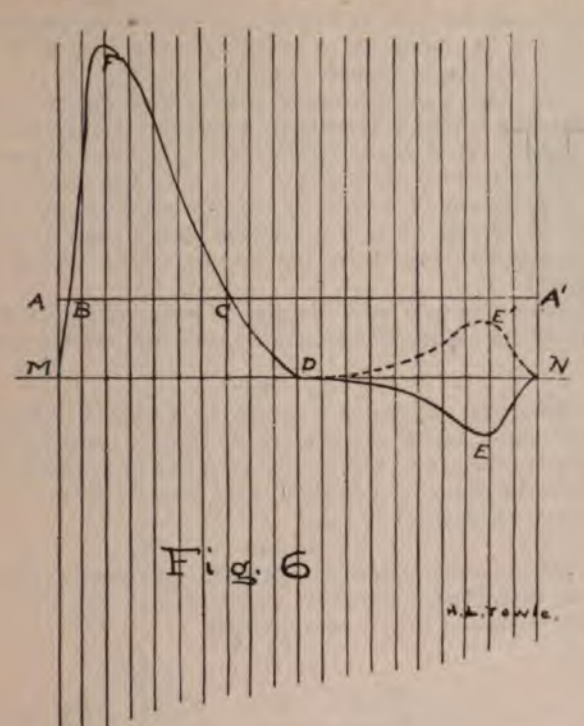
If but one cylinder is to be used, its piston should be as light as it can be made, the speed should be the highest practicable in order to reduce bore and weight, and the cranks will probably be overbalanced. It is possible to secure complete mechanical balance with only one cylinder by the use of two pistons—one in each end—which move in and out simultaneously. An example of this construction, illustrated in The Horseless Age for April 12, may by proper equalization of weights be completely balanced except for the different angularities of the rods. In other cases the pistons are connected through walking beams, linkages and kindred transmissions; or the pistons work on separate shafts geared together. The complexity of these devices—invented as most of them have been by misguided experimenters with stationary engines—is doubtless the main and sufficient reason why they are so seldom found in service; but in vehicle work, where balancing is imperatively demanded, there should be a field for some of them. The last named, in particular, affords means for balancing the torque reaction, and will be again referred to.

The plain single-piston engine is adapted only to the lightest class of vehicle work, and multiple cylinders are usually preferred, both to divide the impulse and for more perfect balance of moving parts. If the power be divided between two cylinders, they may be placed either side by side, as in the marine type, or opposite; and in either case the cranks will be 180 deg. apart. The former has the advantage in point of compactness, and in boats its operation is quite satisfactory; but, as has been shown, its balance is very imperfect, and for vehicle work the other design has the preference.

With three cylinders, two arrangements are possible. Either they may be placed side by side (marine type), with cranks 120 deg. apart, or they may be spaced radially 120 deg. apart around the shaft, with all three pistons working on one crank pin. With the first arrangement, it may be shown that the "algebraic sum" of the values of F, taken for all three pistons at any instant, is zero for all positions of the shaft. This is true so long as the part are alike, regardless of the speed of the motor or the length of the connecting rods, and it is the reason why these motors make so good a showing as regards mechanical vibration. If the cylinders could be made coaxial there would be no mechanical vibration whatever; but since that is of course impossible, there will be a rocking couple, depending on the distance between the cylinders, which is best dealt with by overbalancing.

The second arrangement is the one familiar in the Brotherhood steam engine, and an application of it to steam vehicle motors was recently illustrated in these columns. The effect of working the three pistons on one crank pin is to combine their several inertia forces into one nearly uniform resultant at the crank pin; and the direction of this resultant, which is constantly outward from the shaft, and at no time diverges far from the crank line. It is therefore approximately equivalent to a centrifugal force, and as such may be balanced by suitable weights opposite the crank pin. If it were not for the angularity of the connecting rods this resultant would be constant and always in the crank line; but the effect of the rods is to give it three maximum and three minimum values in a revolution, which may be calculated from the rather formidable expression

$$F_s = 1.5\, F^o \left[1 + \frac{2r}{l} \cos w \,(4 \cos^2 w - 3) + \frac{r^2}{l^2} \right]^{\frac{1}{2}}$$



where F_s is the resultant desired, and F_0 is the equivalent centrifugal force of the reciprocating parts in one cylinder, as above. When $\frac{r}{l} = \frac{1}{4}$, the maximum and minimum values are about 24 per cent. above and below the mean, and the greatest divergence between the direction of the resultant and the crank line is about 14 deg. Practically, however, even so considerable variations as these can give little trouble, because, as they take place in three planes instead of in one, they cannot possibly set up synchronous vibrations. The mean value of F_s is in all cases 1.5 F_0, which would also be its value with the rods eliminated, and this is to be used in calculating the balance weights. Thus, if W be the weight of the reciprocating parts for one cylinder, W' that of the balance weights combined, and r' the radius to the latter's center of gravity, then

$$W' = 1.5\, W\frac{r}{r'}.$$

Turning to four-cylinder engines, the usual and preferred arrangement here is to oppose the cylinders, two and two, and work opposite pistons together on cranks 180 deg. apart. This gives a rocking couple, which may or may not be noticeable, but which should not be serious. It would be possible to eliminate this by putting the two cylinders on one side of the shaft outside of the other two, but the bulkiness and expense of this design would prohibit its use. There are comparatively few cases where the power can to advantage be subdivided so far, and this last case will seldom arise.

The theory of torque reaction has been developed so clearly in recent issues of The Horseless Age that little can be added to it here. It is only lately that the writer has seen it pointed out that what the gas engine cylinder reacts from is principally the inertia of the fly wheel, and only to a minor degree the resistance of the work at the belt. If the shaft were gripped in a vise, the engine would revolve backwards around it; and during the explosion stroke the fly wheel acts as a sort of anchor to keep the shaft from yielding too rapidly. If the cylinder were balanced so as to bring its center of gravity in the axis of the shaft, and if the engine were supported at the shaft by trunnions, the cylinder and the fly wheel would revolve in opposite directions with velocities inversely proportional to their inertia moments. If the fly wheel be light it will be accelerated more rapidly by the given turning moment; and hence the impulse strokes will be performed more quickly, and the cylinder will have less time in which to react. Per contra, with a heavy fly wheel, such as is needed for uniform rotation, the gain and loss of fly wheel velocity in each cycle will be less, and the cylinder reaction correspondingly greater.

If, therefore, the explosion be made to accelerate two equal fly wheels in opposite directions in the same or parallel planes, the cylinder will tend to react equally from both, and its reaction will therefore be divided and balanced against itself. The most obvious way of accomplishing this is to employ two pistons, either in one cylinder open at both ends—as above alluded to—or in parallel cylinders, with simultaneous ignitions and having appropriate provision for mechanical balance. Several schemes of this sort have recently been described or proposed in The Horseless Age, and that of Mr. E. J. Stoddard, in the issue of Dec. 20, the writer believes to meet all the conditions of a perfectly balanced motor.

It is not necessary to the theory, however, that each fly wheel be impelled by its own piston and crank. The same explosion may be made to accelerate both fly wheels; and Fig. 5 outlines a recent design of the author's to embody this principle. As will be seen, it is on the lines of the conventional opposed-cylinder engine, with alternate ignitions; but the secondary shaft C and fly wheel B are rotated in the opposite direction from the crank shaft by means of the bevel gears and pinions shown.* To render the reactions of this or any other impulse motor perfectly balanced, the power should be taken off half from each shaft, and the work of compression should be shared alike by both fly wheels. The latter condition, however, is practicable of fulfillment only when each fly wheel is driven by its own piston, for, as will be seen, the effect of compression in the motor shown in Fig. 5 will be to retard fly wheel A alone, leaving fly wheel B to run ahead as far as the backlash of the gears will permit. To prevent this, with the resulting clatter and loss of balanced effort, it is necessary to take the power off from the secondary shaft alone, and by this means the retarding force on fly wheel B is greater than the compression can ever impose

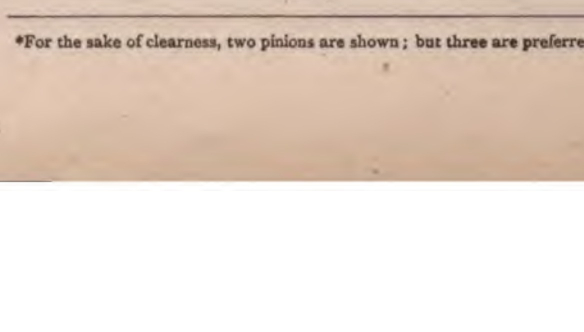


FIG. 7.

*For the sake of clearness, two pinions are shown; but three are preferred.

on fly wheel A, and the gear teeth are constantly held in engagement. There is, consequently, during the greater part of each explosion stroke, an unbalanced reaction of the cylinders in the direction of the rotation of the crank shaft; and the intensity of this reactive force will be that of the turning moment at the pulley or gear D, or, in other words, it will be equal to the mean torque. Furthermore, the work of compression will be performed wholly by fly wheel A, and there will therefore be an unbalanced reaction on alternate strokes due to that fact.

These reactions are of less magnitude than might be supposed, since the mean torque of a four-cycle alternate impulse engine is less than one-fourth the maximum, and because both reactions are in the same direction instead of being opposite, as with the ordinary engine. In Fig. 6 is shown the curve of torque of such an engine during the explosion and compression strokes, as it appears when uncomplicated by the piston inertia. A A' is the line of mean torque, and the curves M B F C D E N and M B C D E' N show the unbalanced reaction forces of the ordinary engine and that shown in Fig. 5. The effect of the piston inertia, at full speed, will be to reduce the "peaks" F and E and make a fuller curve, but the change will not be great.

The maximum torque due to the explosion in a gas engine cylinder is roughly equal to one-half the greatest pressure on the piston multiplied by the crank radius, and the designer will seldom need anything more. For purposes of investigation, however, it is sometimes useful to plot the complete curve, and while this may be done by calculation, the handiest method is that shown in Fig. 7. Here A B and B O represent the rod and crank respectively, and C O is the pressure on the piston for that position. Draw C D parallel to A B, and D O, to the same scale as C O, is the tangential force at B. Hence D O times crank radius = turning moment at that instant.

In conclusion, the writer would say that his purpose in the foregoing paragraphs has not been to compare and adjudge between different types of motors so much as to set forth the fundamental principles according to which motors vibrate and by heeding which they can be balanced. The choice between the single impulse, the double, triple and quadruple impulse types will not often be determined chiefly by the question of balancing. The other factors of economy, space, weight and cost enter in, and other minor ones besides these; and the main problem is, when the number of cylinders is fixed upon, to determine the arrangement which shall give the smoothest running. It is hardly possible to do this without recourse to mathematics; but it is hoped that no reader who can use a book of four-place tables will be at a loss to understand the forces with which he has to deal.

Gasoline and Gasoline Mixtures.

By E. J. Stoddard.

C. E. Wisner, Illustrator.

If I were devoting my attention to the invention or improvement of an oil engine, I would make a careful experimental study of the physical and chemical properties of oils.—Prof. Perry, "Steam and Gas Engines."

Some six years' experience with mixtures of gasoline vapor and air under unusually varied conditions, and a conscientious use of such literature as I could find, has forcibly impressed me with the desirability of a more systematic study of the subject as applied to gasoline engines.

I have seen a gasoline engine running hour after hour and exhausting into an inclosed room without producing a noticeable odor. This alleged objection to the gasoline engine as a vehicle motor would therefore seem not to be insuperable. Prof. Perry says: "A good oil engine mixes its supply of oil with air, explodes it with perfect combustion and utilizes its energy without there being any tarry deposit left to clog the valves."

Mensuration is at the foundation of every science. I wish therefore to call special attention to methods of making measurements.

GASOLINE.

Commercial gasoline is a mixture of the lighter distillates of petroleum, having a specific gravity of about .70 and a boiling point of about 135 deg. F. Its constituent hydrocarbons are said to be mainly of the methane or paraffine series having the general chemical formula.

$$C_n H_{2n+2}$$

Table 1 contains data relative to some of the liquid distillates from Pennsylvania petroleum, compiled from the books of Redwood and of Crew upon petroleum.

TABLE NO. 1.

Name.	Formula.	Per cent. of Carbon.	Per cent. of Hydrogen.	Boiling Point. C.	Boiling Point. F.	Specific Gravity.	Vapor Density.
Pentane....	$C_5 H_{12}$	83.20	16.71	30.2	87	.640	2.538
					(100)		
Hexane....	$C_6 H_{14}$	83.68	16.32	61.3	143	.676	3.053
					(158)		
Heptane...	$C_7 H_{16}$	83.90	16.04	90.4	165	.718	3.547
					(210)		
Octane.....	$C_8 H_{18}$	84 17	15.83	118.5	247	.737	3.992
					(255)		
Nonane....	$C_9 H_{20}$			150.0	303	.756	4.800

There are a number heavier, but the lighter ones are gases at ordinary temperatures. Mr. Redwood quotes an authority to the effect that gasoline is mainly hexane, but he himself seems to assume that the vapor is mainly pentane.

If the chemical formula of the vapor is known, its density relative to hydrogen may be calculated by taking half the molecular weight, and this result divided by 14.45 will give the approximate density relative to air.

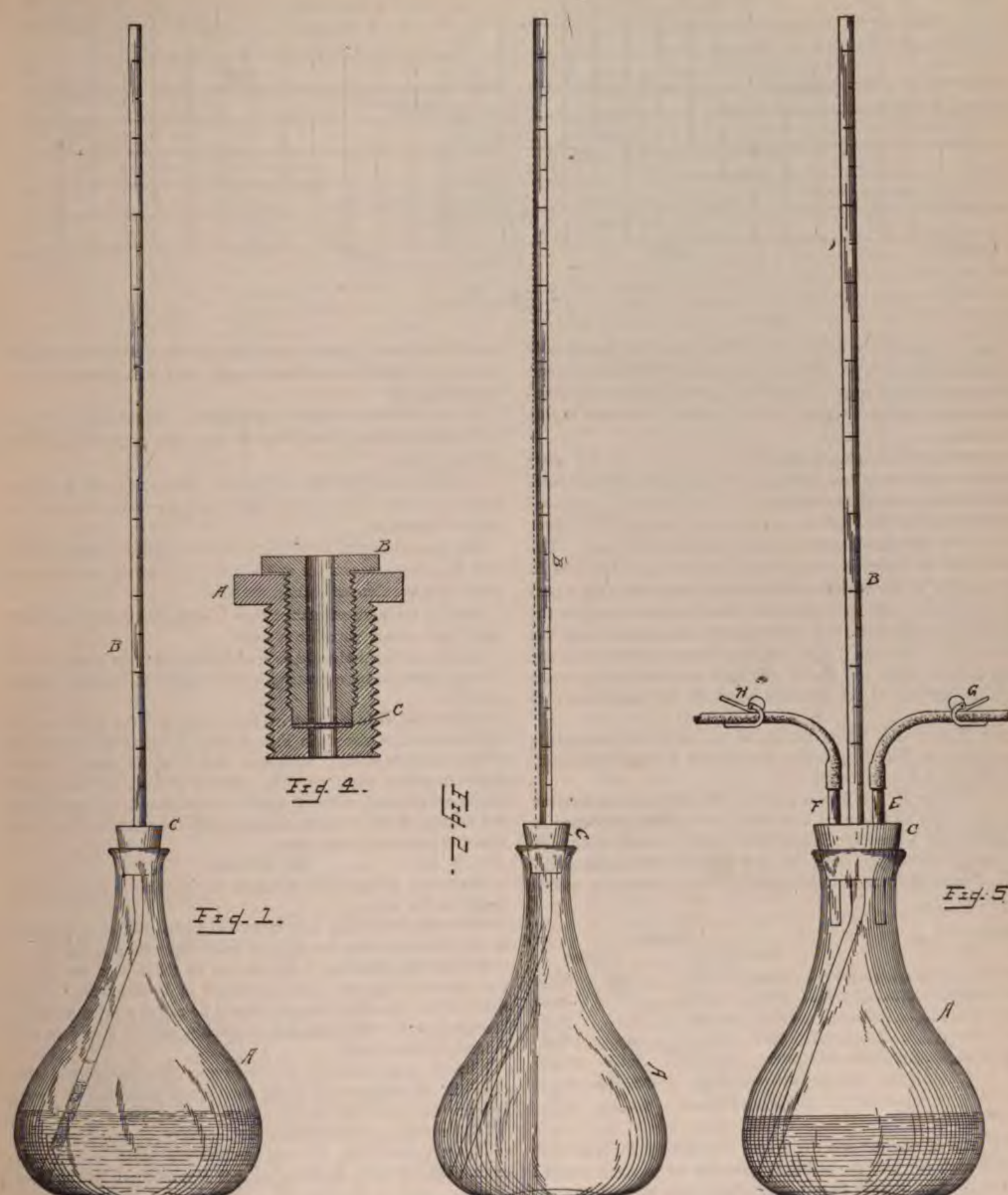
Of course the specimens of so-called gasoline bought in the market vary considerably in their characteristics.

If we can find practical shop methods of measurements it will tend to improve practice generally and we shall have the means of collecting reliable data by which we may advance our theoretical knowledge.

It is customary to rate gasoline by its specific gravity. The device shown on page 17 of the Sept. 20, 1899, issue of The Horseless Age may be read within a limit of error of 1 per cent. if the legs are about 2 ft. long. The Baumé gauge is usually used for obtaining the specific gravity. Tables giving the specific gravity corresponding to the divisions of the scale are frequently published.

It does not, however, necessarily follow that two specimens of gasoline are alike in other qualities because they have the same specific gravity.

If in addition to taking the specific gravity of a specimen we also measure its vapor tension at a given temperature, we shall have greater assurance that it has the same qualities as another specimen having the same specific gravity and vapor tension.



"GASOLINE AND GASOLINE MIXTURES," BY E. J. STODDARD AND C. E. WISNER.

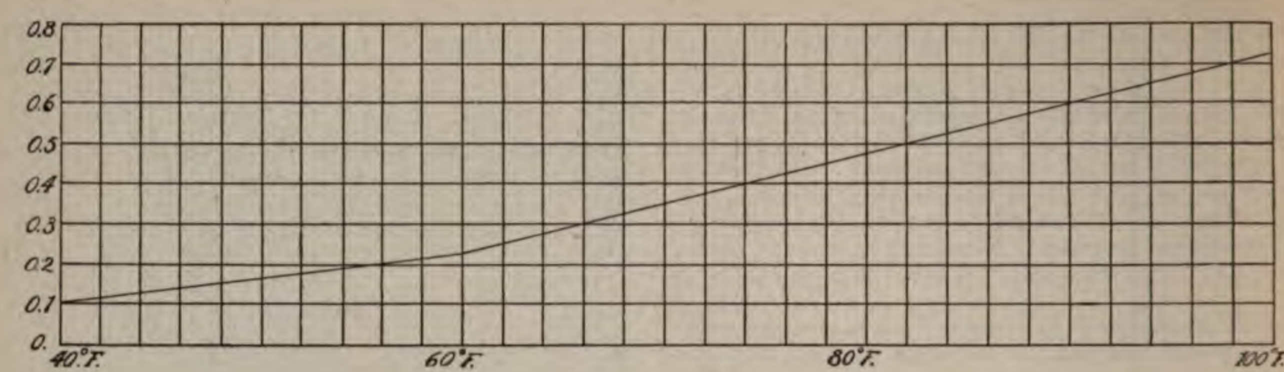


Fig. 3.

Fig. 1 illustrates a device that I have used for the purpose of measuring the vapor tension of gasoline. It depends upon the principle that a vapor always has a given tension at a given temperature without regard to the presence of other vapors or gases.

A is a flask perhaps one-quarter full of water. B is a glass tube about 2 ft. long and perhaps ⅛ in. internal diameter passing air tight through the stopper C. The stopper C is placed in the mouth of the flask so as to close it air tight, the lower end of the tube passing below the surface of the water. The gasoline to be tested is now poured into the top of the tube B. By blowing gently with the mouth at the top of the tube a part of the gasoline is forced out of the lower end and rises to the top of the water, while the remainder of the gasoline seals the lower end of the tube. The mouth is then removed from the tube and the water will rise in said tube to a height that measures the tension of the gasoline vapor at the temperature of the apparatus.

Mr. Hiscox in a recent edition of his book on gas engines says that commercial gasoline should have a vapor tension at 60 deg. F. of 8 in. of water.

Mr. George E. Davis in a paper before the London Section of the Society of Chemical Industry, Jan. 4, 1886, published in The Scientific American Supplement April 3, 1886, gives the following table of pressures "of pure benzine and of gasoline." I have reduced the figures to degrees F. and pressure to inches of water.

Degrees.		Pressures.			
		Pure Benzine.		Gasoline.	
C.	F.	Millimeters of Mercury.	Inches of Water.	Millimeters of Mercury.	Inches of Water.
10	14	13.4	7.18	45.5	23.32
0	32	26.6	14.258	81	43.92
10	50	46.6	24.98	132	70.75
20	68	76.3	40.9	203	108.8
40	104	182	97.55	301.8	161.76

By way of comparison my friend Mr. Henry P. Hart and myself took some of the ordinary gasoline for use in a plumber's torch and placed it in an apparatus like that of Fig. 1, placing the flask in a pail of water and taking the temperature of the surrounding water as that of the apparatus. The tube B was 25 in. long. At 60 deg. F. the water ran over the top, so we tried it again at 45 deg., at which temperature we got a pressure of about 11.5 in. of water. Perhaps it would have been better to use glycerine instead of water, so that the vapor tension at a higher temperature could have been measured with our apparatus.

We then tried a specimen 74 gasoline, bought especially for use in gas engines. At 46 deg. F. there was a tension of about 18 in. of water.

I merely cite this data by way of illustrating the fact that there are quite a variety of fluids that go under the general name of gasoline.

The precautions to be used are that the flask is tightly closed and that the temperature at the time of reading is about the same as at the time of sealing the flask.

Soap is the best substance that I have found for making a tight joint where gasoline is used.

Correction for a change of temperature may be made by allowing about .82 in. of water for each degree F. change of temperature.

If the tube B is bent at its lower end and the flask turned upon its side, as shown in Fig. 2, so as to bring the outer end of the tube on a level with the surface of the water, in the flask, it would seem that the relative volume of vapor and air in a saturated mixture might be estimated by comparing the volume of the water discharged with the volume of air and vapor remaining in the flask.

THE MIXTURE.

There are two general methods of furnishing the gasoline vapor to the air:

First—By delivering a measured quantity of liquid gasoline to the air taken into the cylinder and evaporating it therein.

Second—By drawing a part of the air taken into the cylinder through or over liquid gasoline in a carbureter or its equivalent. Possibly spraying should be called a third method, though I think with gasoline as usually used it would be included in the second.

I know of no objection to the first method except the mechanical difficulties of handling such small quantities of gasoline and certainly this should not be insuperable.

I have seen a proportion of one volume of liquid gasoline to 8,000 volumes of air used successfully—that is, with an engine taking in 50 cu. in. of air per stroke there would have to be delivered $\frac{50}{8000}$ = .00625 cu. in. of gasoline per stroke, which is about the displacement of a ⅛-in. plunger with a ½-in. stroke.

The following very interesting table is taken from Mr. Boverton Redwood's work on "Petroleum:"

TABLE NO. II.

Experiments with Pantane and Gasoline evaporated in Explosion Chamber.

Weight on cover, 8 lbs. Temperature, 65° F.

Volume of Liquid to 100,000 Volumes of Air.	Per cent. of Vapor.	Results obtained on Testing the Mixture with the Flame of a Taper.
3.5	0.672	No ignition.
5.6	.....	No ignition.
5.95	.....	Slight combustion, round large flame.
6.3	.....	More marked combustion, round flame.
6.65	.....	Very sluggish combustion, extending through the mixture.
7.0	1.345	Quiet combustion, scarcely audible, during about 2 seconds.
7.7	.....	Hissing sound; water blown out of seal; cover not lifted.
8.4	.....	Hissing sound; water blown out of seal; cover barely lifted.
9.1	.....	Louder hissing sound of shorter duration; cover lifted.
9.8	.....	Louder hissing sound of shorter duration; cover lifted.
10.5	2.017	Sharp explosion.
11.2	.....	Sharp explosion.
11.9	.....	Sharp explosion.
12.6	.....	Sharp explosion.
13.3	.....	Sharp explosion.
14.0	2.690	Sharp explosion.
14.7	.....	Sharp explosion.
15.4	.....	Sharp explosion.
16.1	.....	Sharp explosion.
18.8	.....	Sharp explosion.
17.5	3.362	Slightly less violent explosion, but cover lifted and outburst of flame.
18.2	.....	Slightly less violent explosion, but cover lifted and outburst of flame.
18.9	.....	Slightly less violent explosion, but cover lifted and outburst of flame.
19.6	.....	Roaring sound; cover slightly lifted.
20.3	.....	Roaring sound; cover slightly lifted.
21.0	4.034	Prolonged roaring sound; cover practically not lifted.
28.0	5.379	Mixture ignited silently at vent, and flame then traveled into the chamber, where mixture continued burning quietly for 3 seconds.

The experiments from which the data was derived were made at atmospheric pressure. It is probable that weaker mixtures can be used when the charge is compressed. With 12.25 volumes of liquid to 100,000 volumes of air there would have been just enough oxygen furnished by the air to completely burn the hydrocarbon.

In the use of a carbureter the mixture is liable to vary from time to time from the following causes:

First—If the temperature of the gasoline or air changes the same amount of air drawn through it will carry a different amount of the vapor with it.

In the following diagram (Fig. 3), taken from M. Redwood's work, the abscissas indicate the temperatures and the ordinates the volume of gasoline taken up by a given volume of air.

Possibly this effect may be compensated for by causing the pressure of the gasoline vapor in an inclosed vessel to adjust the mixing valve.

Second—As the gasoline evaporates the part remaining increases in specific gravity, and becomes less volatile, so that the same quantity of air drawn through it will carry less vapor.

For these reasons, the second method of mixing gives very uncertain results, and of course accidental causes may vary the mixture at any time with either method of mixing. For this reason it is very desirable to have some method of

ESTIMATING THE MIXTURE.

If the engine is run a few strokes without ignition and the mixture thereby forced into an inverted bell gasometer, or other receptacle from which it may be drawn in a steady stream, and if a small jet from said receptacle is ignited, one may judge roughly of the nature of the mixture by observing the color of the flame. A pale blue flame with a small red cap I have found to indicate an active explosive mixture.

Second—In my judgment every gasoline engine cylinder should be provided with an opening for the indicator. This opening may be ordinarily closed by a plug like that shown in Fig. 5, which consists of two screw-threaded sleeves A and B, one within the other. At the lower end of the sleeve B is a sheet mica disk, C, which is pressed tightly against the shoulder on the sleeve A by screwing the sleeve B down upon it.

Thus the aperture through the sleeves is closed by this mica disk and one may see through said aperture into the cylinder and observe the color of the flame when ignition takes place, and thus judge of the nature of the mixture.

If the opening is over the point at which the spark is formed one can judge of the action of the igniter also, by looking through the aperture through the plug.

Third—I will submit the following method and apparatus to your judgment, though I have not as yet used it enough to speak with any certainty of it.

The apparatus (Fig. 5) is the same as that shown in Fig. 1, except that there are two short tubes, E F, through the stopper. Each of these tubes has a piece of rubber tubing attached to it having a pinch cock, G H, upon it.

The mixture to be estimated is passed through said tubes into and out of the flask until the air originally in the flask is replaced by said mixture. The pinch cocks are now both closed, and the gasoline from which the vapor of the mixture was drawn is passed through the tube B as described in connection with Fig. 1, and the height to which the water rises observed. The difference between this height and the height to which the vapor of such gasoline forces water in the apparatus of Fig. 1 measures the amount of gasoline vapor that was in the mixture.

Fourth—Mr. George E. Davis, in the article above referred to, measured the amount of hydrocarbon vapor in a gaseous mixture by absorbing such vapor by means of olive oil, and measuring the quantity absorbed.

I sealed one end of the glass tube about 21 in. long and saturated the air in it with gasoline vapor. I then placed its open end under the surface of some olive oil and caused the oil to run along the walls of the tube while holding its unsealed end closed with my finger. On again placing said end of the tube under the surface of the oil, the oil rose rapidly into the tube to a point about 3½ in. from the end of the tube, indicating a free absorption of the vapor. It would seem from this experiment that there was something more than 16 per cent. by volume of the vapor in the mixture. The action seemed complete in a few minutes. After standing over night the oil had risen no further in the tube.

If olive oil is placed in one of the absorption flasks of an Orsat gas apparatus, such as is described, for instance, in Prof. Gill's "Gas Analysis for Engineers," it would seem that such apparatus might be used to accurately measure the volume of vapor in a mixture.

Should the above observation prove of interest I shall venture to speak of the charge subsequent to ignition. This whole important subject seems exasperatingly obscure in view of the fact that reliable data appears to be readily accessible. However, the practical demand for information upon the subject is but now becoming imperative.

Multi-Cylinder Engines.

By P. M. Heldt.

Leaving out of consideration motor tricycles, it may be said that by far the greater number of gasoline vehicles built are equipped with engines of two or more cylinders. While it is easily seen that in some respects the single-cylinder engine would be greatly preferable to an engine with several cylinders, when all points are considered the balance of advantage seems to be in favor of multi-cylinder engines. The advantages gained by the use of multi-cylinder engines are lighter weight, steadier running, and, in some cases, greater compactness. The number of cylinders to which makers have so far limited themselves is four, but with the various relative positions of the cylinders and different forms of cranks a great number of constructions can be obtained.

Taking up first the double-cylinder engine, we have the following variations: Twin cylinder with single crank, twin cylinder with double crank, opposite cylinder with single crank, opposite cylinder with double crank, and lastly double-cylinder engine with center lines of cylinders making an acute angle (usually about 20 deg.) with each other, and the plane through center line of cylinders at right angles to center line of crank shaft.

The reduction in weight gained by the use of multi-cylinder engines as compared with single-cylinder engines is largely the difference in the weight of fly wheels required. In a double-cylinder engine of the same power as a single-cylinder engine the impulse due to the explosion is only half as large, as there are twice the number of explosions in a given time, an equal angular velocity being assumed for the two cases. But owing to the lighter weight of the reciprocating parts the more nearly balanced motion of these parts and the shorter stroke, the double-cylinder engine may be operated at a considerably higher speed than the single-cylinder engine and the ratio between the forces of explosion will therefore be even greater than that given. In a twin-cylinder engine with single crank the explosions occur at even intervals and there is one explosion for every stroke; but in a twin-cylinder engine with double crank the two explosions occur during the same revolution, while during the next revolution there is no explosion. With a single crank there is but one idle stroke between explosions, while with a double crank two idle strokes and two power strokes occur one after another. For this reason a twin-cylinder engine of given bore and stroke requires considerably less fly wheel capacity when provided with a single crank than when provided with a double crank. With a single crank the pistons and connection rods of both cylinders move forward and backward at the same time, and as the back and forth motion of these parts is not counterbalanced, such an engine vibrates as much as a single-cylinder machine. In a twin-cylinder double-crank engine, however, while one piston moves back the other one moves forth and the motion of the pistons is very nearly balanced. The advantages of these two forms are combined in the opposite-cylinder double-crank engine. Here the explosions are evenly spaced and the balance of the reciprocating parts is more complete than in the twin-cylinder double-crank engine, for the reason that the center lines of the cylinders are nearer together. This type of double-cylinder engine has been much used for motor vehicle work. It is, together with other forms of opposite-cylinder engines, subject to the objection that they are not nearly as compact as twin-cylinder engines. Sometimes opposite-cylinder engines are placed crosswise in the wagon, but this cannot be done with engines with more than 5' stroke, as with engines of longer stroke the length of the engine and consequently the width of the wagon body would be too large. When placed across the wagon and in front of the operator's seat, as in some French machines, the valves and igniters are easily gotten at. But when placed as usual, lengthwise in the wagon, one cylinder head comes under the seat and the valves and igniter of this cylinder are not very accessible. The wagon body has to be of extraordinary length to accommodate the engine. As stated above, the center lines of the cylinders are nearer together in the opposite-cylinder engine than in the twin-cylinder engine, and for this reason the width over the bearings of an opposite-cylinder engine is less than the width over the bearings of a twin-cylinder engine, with the same cylinders. This is a rather valuable feature, as the speed varying mechanism is placed, as a rule, on an extension of the engine shaft and space across the wagon body is limited, as a very wide body gives a vehicle a clumsy appearance. Opposite-cylinder single-crank engines are inferior to other types in every respect and are simply mentioned as a possible form of construction. The last-named type—double-cylinder engine with the center lines of cylinders making an acute angle with one another—has been used by Daimler and others and has the advantage of great compactness, both in length and width. With a single crank the explosions are nearly evenly spaced; but the motion of the pistons is not balanced. A double crank can not be used with this type, as the middle crank arm would interfere with the connection rods. This could be remedied by giving the cylinders an offset against each other in a direction parallel with the crank shaft, but such a proceeding would increase the width of the engine and it would then have little advantage over a twin-cylinder engine, which is, of course, easier to build. The forms of double cylinder engines here enumerated do not, of course, include every possible construction. In attempts to produce perfectly balanced engines, double-cylinder machines with separate cranks, geared together, have been made, and also have the so-called double-piston engines been made in double-cylinder form. In the latter type the explosion occurs between two pistons which move in opposite directions. The crank is sometimes placed at one end of the cylinder, at others centrally below the cylinder. These engines, while presenting an undoubted advantage from the view point of balanced running, are somewhat complicated, and the increased number of bearings to be looked after is certainly a strong argument against their general adoption.

In triple-cylinder engines the three cylinders may be placed side by side and the engine be provided with a triple crank,

of which the separate cranks are 120 deg. apart, or the three cylinders may be placed in a plane making angles of 120 deg. with each other. In the latter case only a single crank is required. In a triple-cylinder engine with cylinders side by side and cranks spaced 120 deg., the motion of the pistons, connection rods and crank is balanced and the explosions occur at even intervals. Such an engine runs therefore quite steady and requires but a small fly wheel. It can also be built very compactly, and the only objection to it is the multiplicity of parts. The second form of triple-cylinder engine mentioned will hardly be used, as it requires too much space.

Four-cylinder engines have been used by a number of automobile builders, and especially for powerful racing machines. At first the difficulty with these machines was that they required too much electricity for ignition, but now that spark generation can be had this difficutty has been solved. The usual arrangement of the cylinders is two and two together on opposite sides of the crank. With a double crank an explosion can be had at every stroke, or, as is sometimes done, two cylinders at opposite sides of the crank may be operated simultaneously, which equalizes the pressure on the cylinder heads and thus reduces the vibration of the engine. In the latter case, of course, the explosions are one revolution apart and a larger fly wheel is necessary. In a four-cylinder engine of a capacity sufficient to propel an ordinary pleasure vehicle, the dimensions of the cylinder are small and such engines can therefore be easier placed crosswise in the wagon body. It is also possible to make jacketless engines of considerable size when four cylinders are employed.

The question of the number and relative position of the cylinders of the engine is always one of the most interesting ones to be solved when starting out to design a gasoline vehicle. That there is no solution which fits all cases ought to be apparent from the fact that for tricycles and very light vehicles or voiturettes the single-cylinder engine is almost universally used, while for pleasure and business vehicles of greater weight multi-cylinder engines are in the lead. There are other considerations aside from the weight of the vehicle which determine which form of engine is best suited to a particular case. For a fine pleasure vehicle, for instance, it is quite essential that there be as little vibration as possible, while for a racing machine great power combined with light weight is one of the most serviceable qualities. The question of the number of cylinders is sometimes argued as follows: If two cylinders are better than one, then three cylinders are better than two and four cylinders still better than three. But this reasoning is entirely fallacious, as is easily apparent when following it out a little further. Of course, the evenness of the power increases with the number of cylinders, but so does the complication, and there is for every case a happy mean which best satisfies the conditions.

Much has been said for and against the advisability of concealing the machinery in the body of the vehicle. It is stated that it is always a pleasure to look upon any well proportioned machine, but at the present time purchasers are mostly taken with the ghost-in-the-box idea, and have a fancy toward an invisible something which propels the vehicles at top-notch speed. When the machinery is to be placed inside the wagon body it must of course be very compact, for otherwise the vehicle becomes a machinery box on wheels with a carriage seat on top. For this reason the twin-cylinder engine is often preferred to opposite-cylinder engines.

With a number of cylinders close together, as in twin or triple cylinder engines, a single feeder or vaporizer may be used for all. With opposite-cylinder engines this cannot well be done, as it is desirable to have the vaporizer close to the intake valve.

In comparing the merits of the various constructions mentioned it is well to remember that a fairly large fly wheel will steady the motion of the vehicle on bad roads and permit the vehicle to be drawn out of bad places by first running the engine up to speed and then throwing the clutch. In this respect it is interesting to compare two well-known American vehicles in which the writer has enjoyed a ride. The one has a single-cylinder engine, which of course is provided with a heavy fly wheel, while the other one has a double-cylinder engine and a rather light fly wheel. The former, when the clutch is operated a little too quick, always starts off with a jerk, while in the latter the clutch must be operated rather cautiously lest the engine should be stalled. Wagons of the latter make have nevertheless made quite a number of cross country tours, which shows that they are not lacking in power. Fly wheel power has often been mistaken for engine power, and the writer remembers one Chicago inventor who would exhibit the "power" of his vehicle by placing a wooden beam in front of the wheels, running the engine up to speed, suddenly throwing the clutch and jumping the beam. This "tour de force," although usually deeply impressing the spectators, failed to be of use when the inventor struck sandy roads.

Gasoline Vaporizers and Carbureters.

By Henry W. Struss.

Approaching the subject of carbureters we find it one of absorbing interest, though naturally not to the extent of the motor itself. As to the question, "What kind of a carbureter or vaporizer shall we use?" the answer will depend on the design of the engine. Let us examine a number that have been patented and others that are suitable for or have been put into actual use on vehicle motors.

By the term carbureter we generally understand an apparatus in which the air is drawn through a comparatively large body of liquid; by vaporizer, an apparatus where the gasoline is sprayed or atomized and thus mixed with the air; but, of course, it is a carbureter as well as the other form.

About as simple a form of carbureter as can be used is that of the De Dion tricycles, shown in Fig. 1. A float keeps the air inlet tube at a constant position in regard to the level of the gasoline, a branch from the exhaust pipe passes through to heat the gasoline and assist evaporation, and a valve at the top provides for the addition of extra air to correct the mixture before passing to the motor. The small box at the top also contains the throttle valve.

In Fig. 2 we see the carbureter used by the Daimler Co. In both of these the lighter part of the gasoline is liable to be

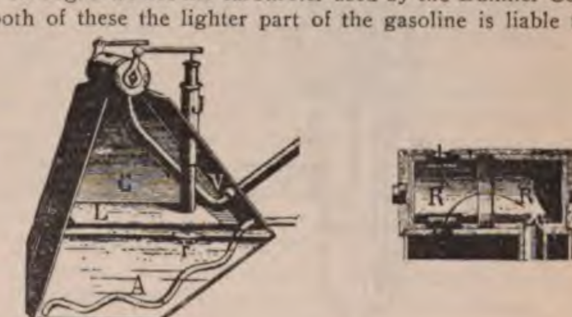
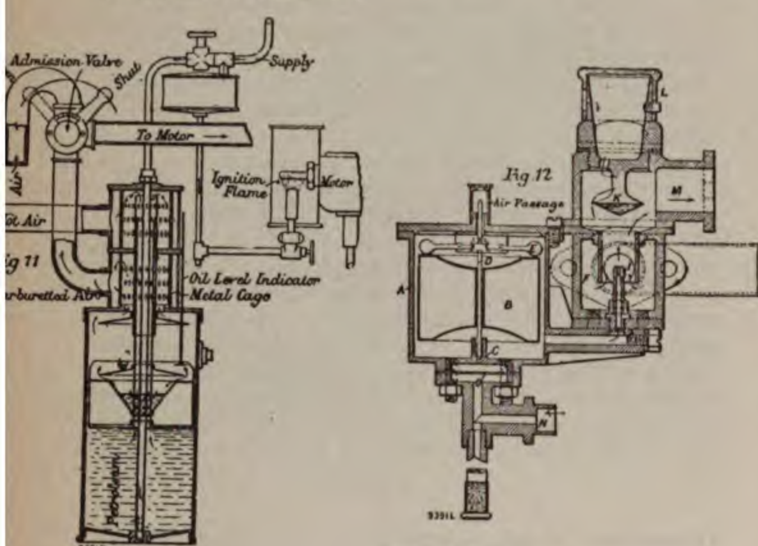


FIG. 1.

drawn off first, leaving a heavier liquid as the bottom is reached.

The Bergmann carbureter was fully described in The Horseless Age of February, 1897. In this a smaller quantity of the fluid is required and the float actuates a valve controlling the admission of the gasoline.



FIGS. 2 AND 5.

In Fig. 4 is shown a very simple form of vaporizer without moving parts. The gasoline is supplied by pump operated by the engine and the excess flows through the overflow pipe and is returned to the supply tank along with any surplus that is not evaporated by the air passing through the drip chamber. As shown, the supply to the spray nozzle is regulated by a needle valve.

In the following three vaporizers a float controls the inlet opening and the supply of gasoline is kept at a constant level. There is a marked similarity in the general features of these three. In the first two, Nos. 5 and 6, which are French productions, the primary supply of air is previously heated, but the extra inlets to correct the mixture supply cold air. In No. 7, the Duryea vaporizer, both the supply of air for suction and the one for correction are drawn from the same source, as the drawings plainly show, the mixture being afterwards heated before entering the cylinders.

Usually in descriptions of this class of vaporizers much is made of the addition of cold air, which cannot be of any special benefit, while the object of the additional air is to modify the mixture and not the temperature of same. The quantity of gasoline sucked up at normal speeds being usually excessive, the admission of additional air is necessary, or, to put it in

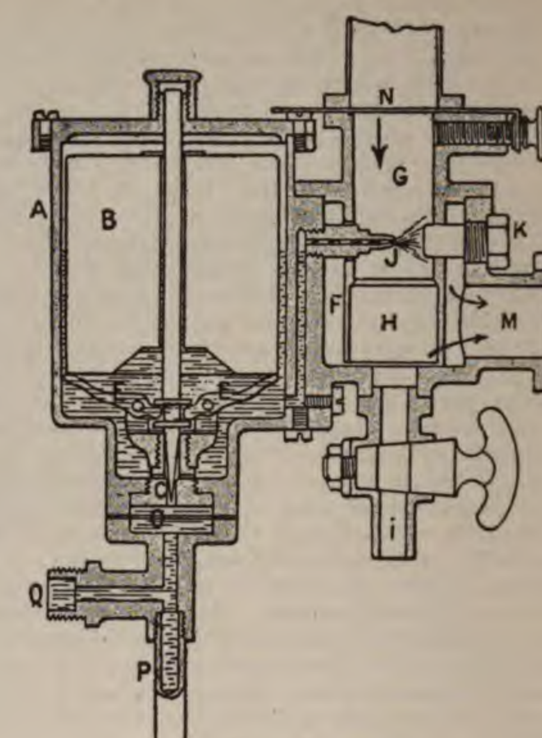


FIG. 6.

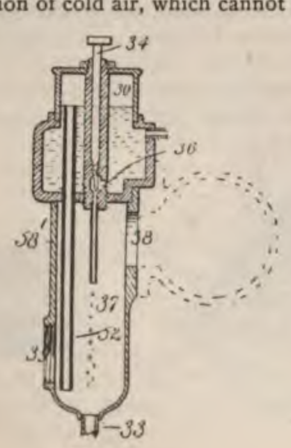
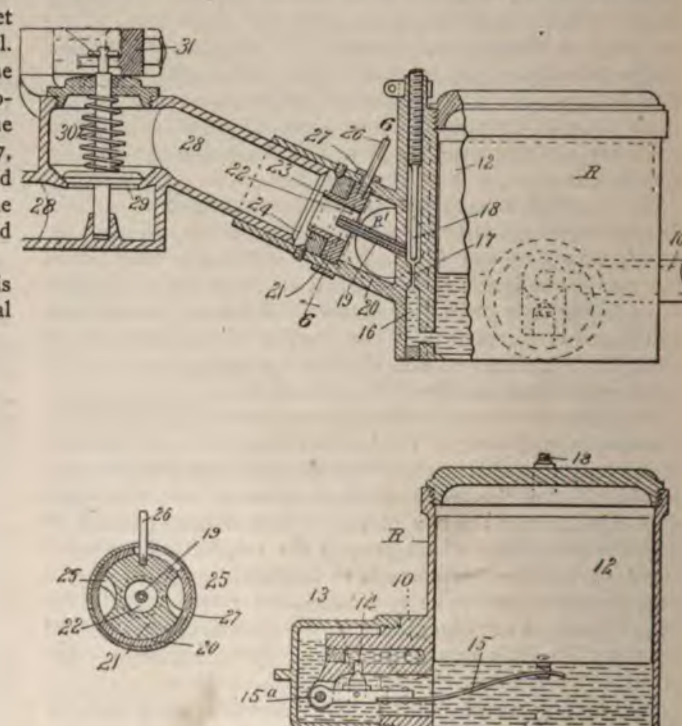


FIG. 4.



DURYEA VAPORIZER. FIG. 7.

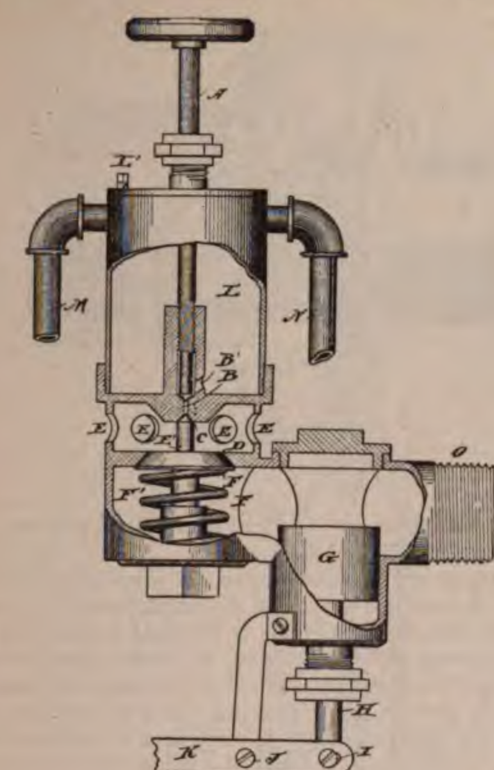


FIG. 8.

another form, by opening ports above or beyond or alongside the suction tube the suction of gasoline from the spraying nozzle is reduced in proportion. In using vaporizers of this class on motors that are to be run at various speeds, some arrangement must be made to adjust extra inlets according as the speed is changed. At very slow speed the air passing through the suction tube would not draw enough gasoline unless the extra inlets were more or less closed in proportion to the openings required for faster speeds.

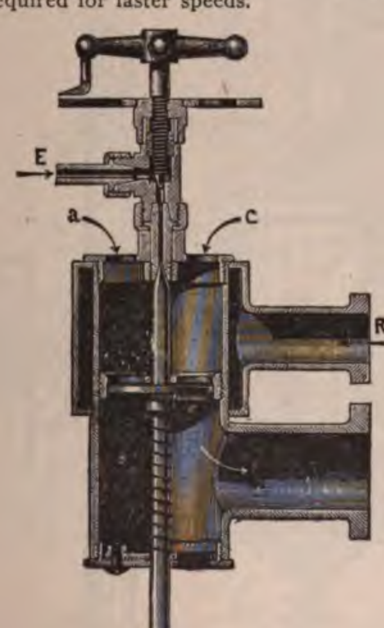


FIG. 9.

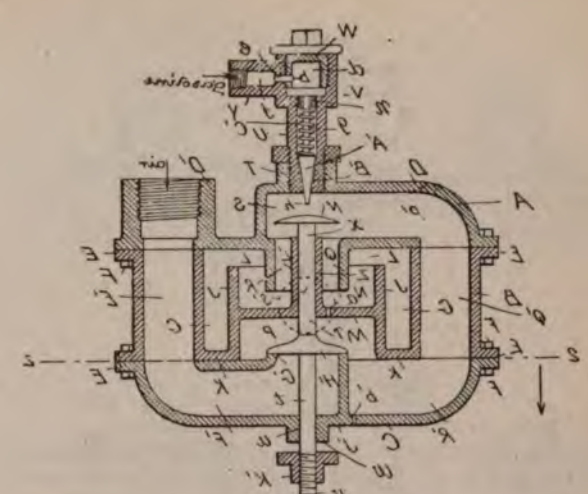


FIG. 10.

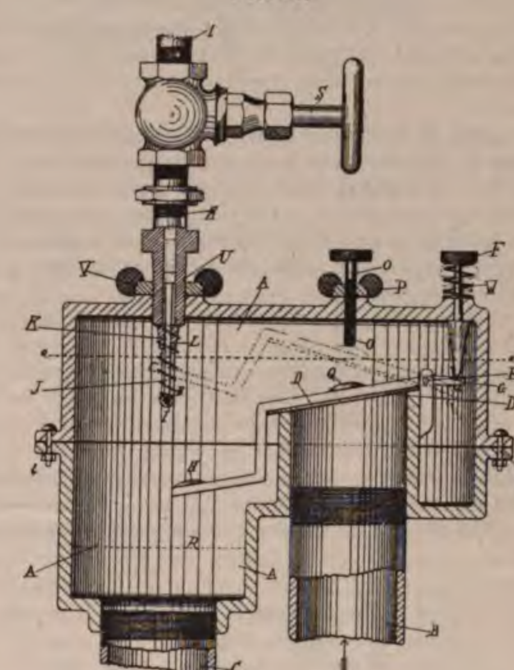


FIG. 11.

In Figs. 8 and 9 are shown two vaporizers that are practically the same except as to details. No. 8 is an American invention. In practice it has a casing not shown on the drawing, by means of which heated air is supplied in cold weather, while No. 9, which is a European invention, has the exhaust passing through the jacket at R. In No. 8 the gasoline is supplied by a pump, one of the pipes shown being the supply, the other the overflow pipe. Both have needle valves to regulate the amount of gasoline that can be delivered at each suction stroke of the piston. No. 9 has means at the bottom for admitting cold air, the necessity for which does not appear.

Figs. 10 and 11 show vaporizers in which the suction of the motor throws an extension of the valve against a spring actuated needle valve, the extent of throw being adjustable and consequently the amount of gasoline delivered each time.

In the vaporizers shown in Figs. 12 and 13 the suction of the motor draws the needle valves direct from their seats by means of the disks attached to them, the object of the disks being

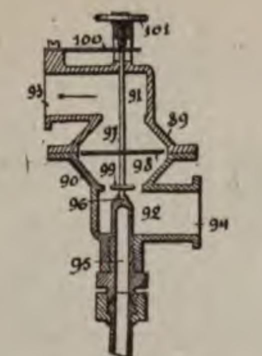


FIG. 12.

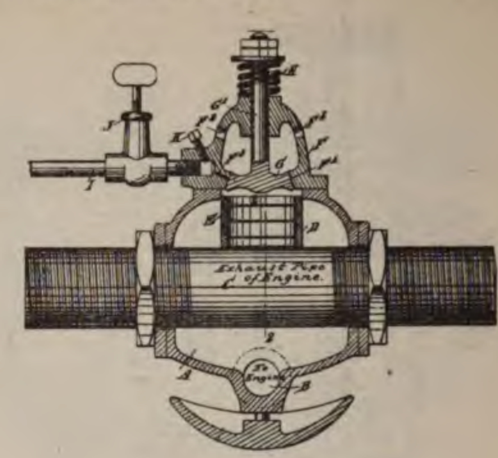


FIG. 14.

also to cause a better evaporation of the gasoline, and in No. 13 the disk is so constructed as to revolve. As it is of much importance to secure a uniform and unvarying mixture, and uniformity of temperature of the air supplied will help to this end, the designer of No. 13 covers the vaporizer with a non-conducting material and relies on the rotating disk for causing a thorough evaporation, supplying only air at normal temperature.

Figs. 14 and 15 both show delivery of the gasoline through small holes in the valve sets, but are otherwise different. The action of No. 14 is plainly enough shown in the drawing. In No. 15 the openings for air at the bottom are very small, the intention being to draw a very rich mixture, as a special inlet valve for air alone opens at the same time as the one in the vaporizer directly into the cylinder.

In the apparatus shown in Fig. 16, used on the Winton carriages, the gasoline inlet valve is connected directly to the inlet valve of the engine, but there are two other features that deserve notice. One is the provision of a dash pot for the purpose of relieving the force of the return stroke of the valve to its seat. The other feature is governing the speed of the motor by the admission of air under pressure through the tube L into the chamber K, the piston I thus answering a twofold purpose. The pressure of the air, which is supplied by a pump connected with the motor, is regulated by hand and the speed of the motor in accordance therewith.

Figs. 17, 18 and 19 are of vaporizers where the gasoline is delivered in measured quantities, still are different from a mere pump. In No. 17 the gasoline is delivered through the tube 25 into grooves in the spindle 92, the excess being returned by tube 32. Every time the spindle is depressed this measured quantity of gasoline, plus what may flow at the same time through the tube 25, is drawn down into a chamber below, where it mixes with the air drawn through the inlet valve at that point.

In No. 18 the valve I, which is rotated by means of shaft G, delivers the gasoline taken up by the small holes in its outer circumference to the chamber or passage below, where it mixes with the air. The speed of rotation is regulated by a governor.

In Fig. 19 the vaporizer is combined with the rotating inlet and exhaust valve of a motor having this feature. The gasoline flows through a tube to the small chamber 40, whence it is withdrawn by small pistons shown at E^1, E^2 and E^3, and deliv-

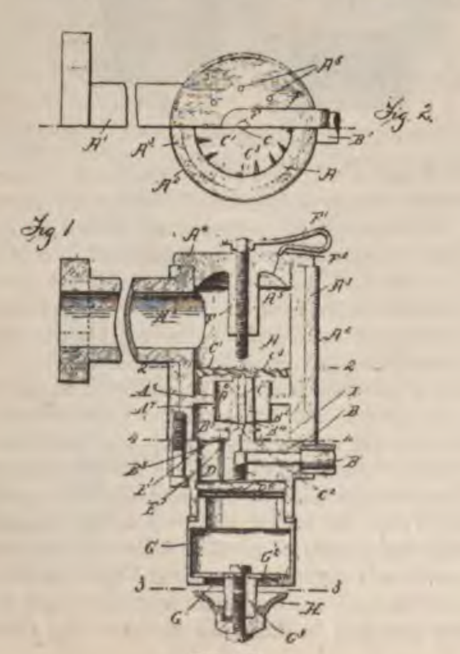


FIG. 13

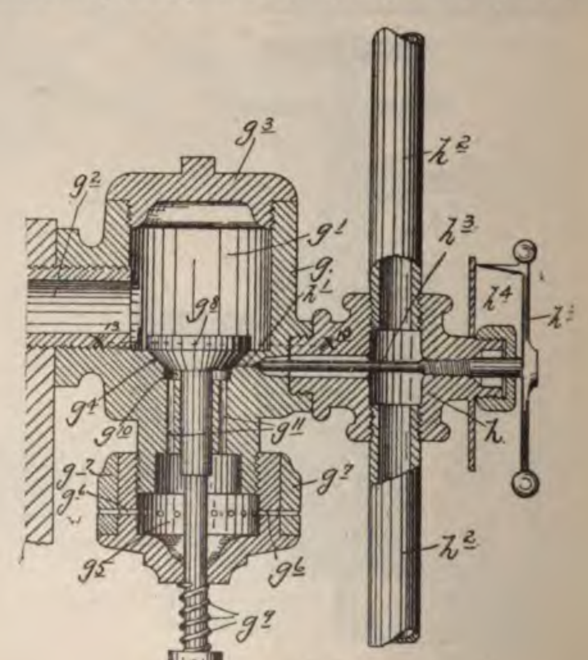


FIG. 15.

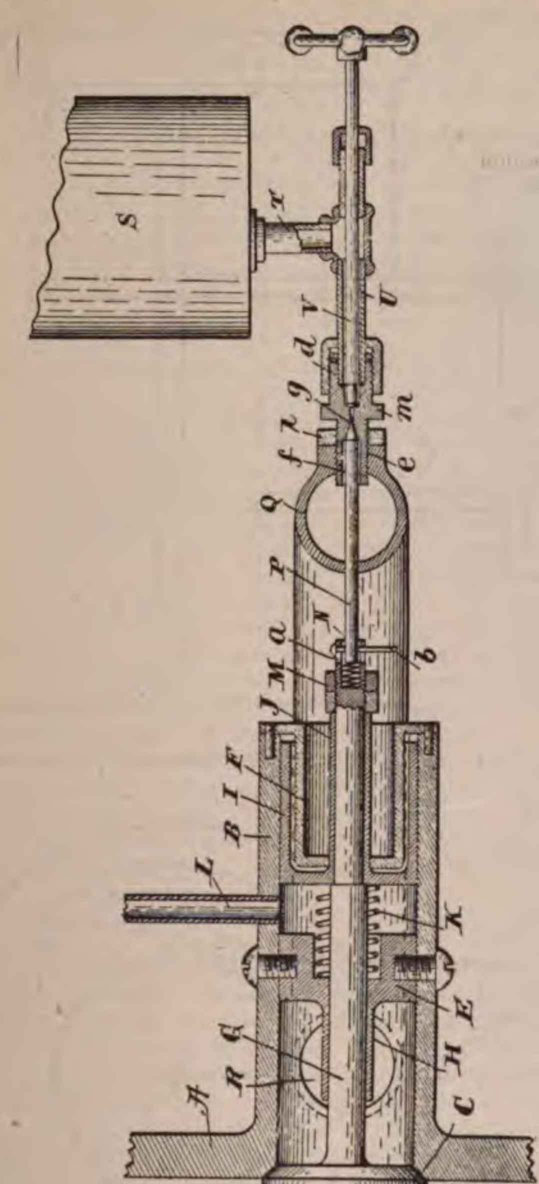


FIG. 16.

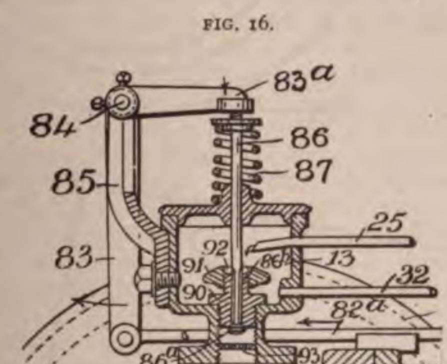


FIG. 17.

ered to the chamber below, which is in connection with the adjoining chamber, and mixed with air. The pistons are actuated by the levers, as shown, the piece O being non-rotat-

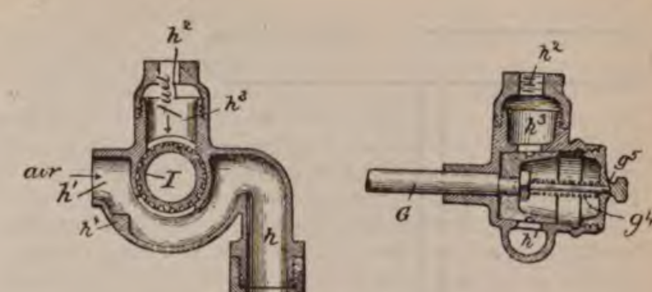


FIG. 18.

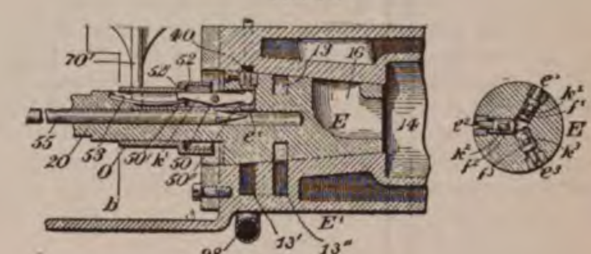


FIG. 19.

ing and having an internal cam face. The length of throw of the pistons is regulated by the pointed soindle 55. It is hardly necessary for the purposes of this article to give a more extended description.

A study of the vaporizers here shown, as well as others that have appeared lately in The Horseless Age, should contain enough suggestions to aid the inquiring mind as to the best form of vaporizer adapted to his motor.

Balancing A Motor Carriage.

By E. C. Oliver, M. E.

Much has been said and much more will probably be said concerning the balancing of motor carriages. Ever since there has been a demand for high rotative speeds and for engines that would run without undue vibration on the upper floors of factory buildings, where a foundation was impossible, engineers have given considerable attention to the balancing of this class of motors, and now that the demand of the horseless vehicle is for a machine that will run not only without a stable foundation but at the same time without vibration, the question is open for still more careful consideration.

There seems, however, to be some diversity of opinion as to the real cause of vibration. Is it due to the unbalanced torque or unequal pull of the motor, or is it due to the unbalanced condition of the motor itself? As the remedy must be suited to the cause, it will be necessary to investigate the cause before prescribing a remedy. Let us then give some attention to the practical analysis of these two questions and see if we may draw any conclusions whereon to base our further work.

For the purpose of comparison suppose we have a motor carriage of the type shown in Fig. 1, the weight of which is 1,000 lbs. It is driven by a single-cylinder 5-h.p. motor running 600 revolutions per minute; the stroke is 6 in., connecting rod 15 in. long, and the reciprocating parts weigh 15 lbs. The fly wheel is 12 in. in diameter and weighs 100 lbs.

Consider first the case of unbalanced torque. Assuming the motor to furnish 5-h.p., there must be at every fourth stroke 550 foot-pounds of work applied by the explosion of the gases, one-fourth, or 137 foot-pounds, of which is used at each stroke

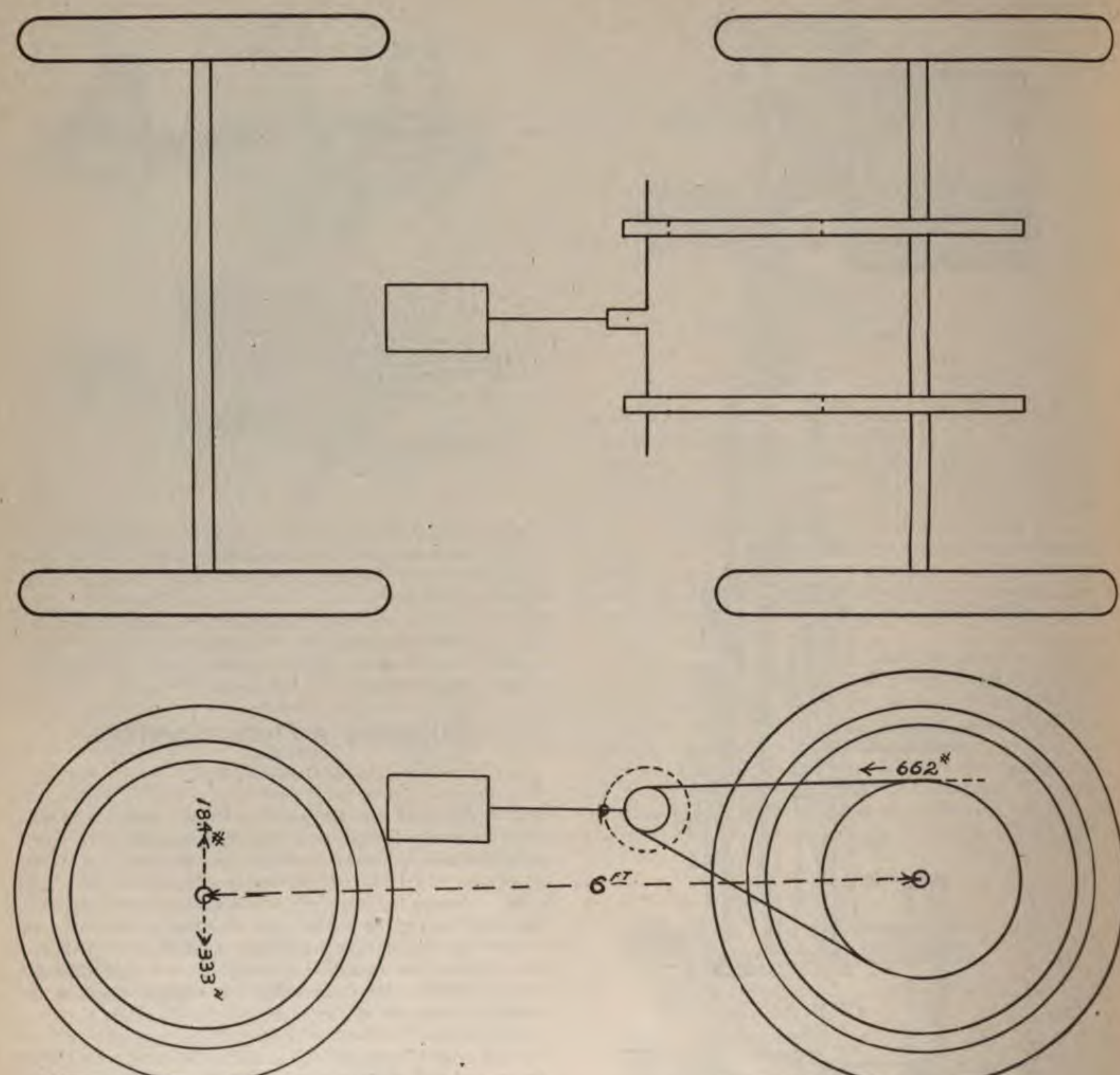


Fig 1

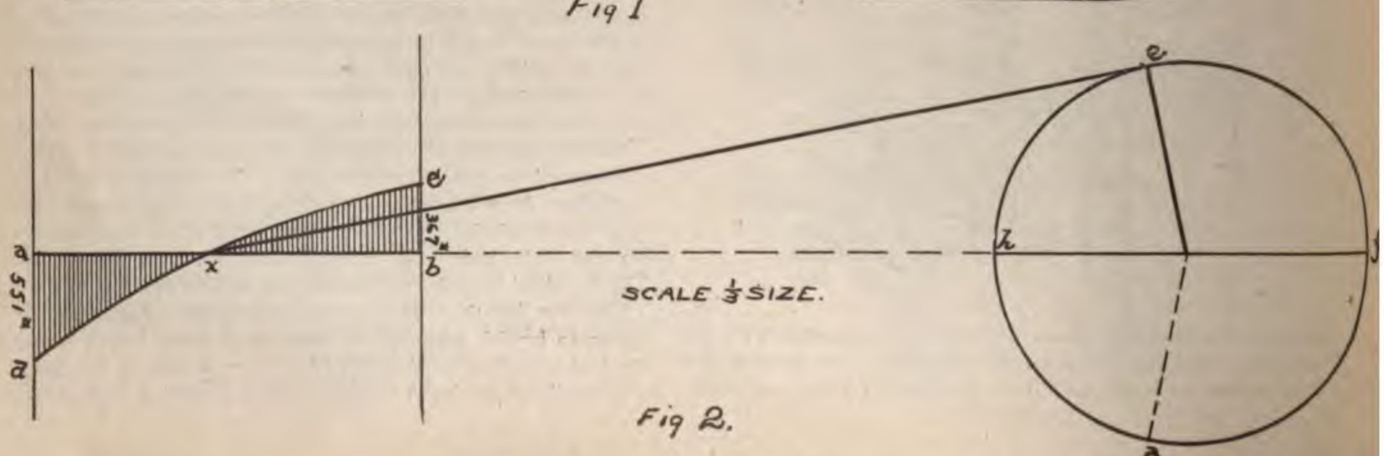


Fig 2.

BALANCING A MOTOR CARRIAGE, BY WM. E. C. OLIVER.

of the engine in propelling the vehicle. There is therefore during the explosion stroke 550 — 137, or 413 foot-pounds of work to be absorbed. A fly wheel weighing 100 lbs. with a mean radius of 6 in. and running at 600 revolutions per minute stores up $\frac{W V^2}{2 g}$ or 1,545 foot-pounds of energy. If this excess of energy were put into the fly wheel alone the total energy at the end of the explosion stroke would be 1,535 + 413, or 1,948 foot-pounds, and the speed of revolution would thereby he increased to 762 revolutions per minute, or 12.7 revolutions per second. If, however, the carriage is moving 15 miles per hour, or 22 ft. per second, the energy stored up in it is $\frac{1000 \times 22^2}{2 \times 32^2}$ or 7,500 foot-pounds, and since the engine and carriage are connected through gearing any increase in the velocity of the engine must necessarily produce a relative increase in the velocity of the carriage, and consequently a portion of the energy must be absorbed in the vehicle itself as well as in the fly wheel. The amount absorbed by each is directly proportional to the product of their weights by the square of their velocities, or as $W V^2$. This product for the vehicle is approximately five times as great as for the fly wheel; hence the carriage will absorb four-sixths and the fly wheel one-sixth of the excess of energy given out by the explosion. The total energy in the vehicle at the end of the explosion is therefore $7,500 + \frac{5}{6} \times 413 = 7,845$ foot-pounds, and the speed is consequently raised to 224 ft. per second.

Now this 5-6 of 413 foot-pounds of work is transferred to the vehicle in one-half of one revolution of the motor. If the sprocket gear on the engine shaft is 4 in. in diameter a point on the pitch line of that wheel will travel 6¼ in. during the one-half stroke, and the pressure transmitted through the teeth at the pitch line will be $\frac{345 \times 12}{6\frac{1}{4}}$ or 662 lbs., which amounts to a turning moment about the engine shaft of 110 lbs. acting at the radius of a foot. This turning moment finds its reaction in the rear axle, the tendency being to lift the carriage off the front wheels or to rotate it about the rear axle. If the wheel base is 6 ft. and we consider the weight to be one-third on the front wheels and two-thirds on the rear wheels, it would require 333 lbs. acting at 6 ft. from the rear axle to lift the wheels clear of the ground. Our moment, however, is but 110 lbs. acting at 1 ft. from the axle, or 18.4 lbs. acting at 6 ft. This being considerably less than the amount required to lift the carriage, there will be but a tendency to lift or a slight strain in the connecting members.

The effect of the unbalanced torque of the motor in this carriage, then, is to cause the speed to fluctuate five times per second between 22 and 22.4 ft. per second and to set up strains in the connecting members between the front and rear axles of the vehicle with the same frequency, the effect of which strains may be felt more or less, depending somewhat on the design of the carriage—the stiffer the connecting frame, generally speaking, the less will the strains be felt. They should, however, in any case be inconsiderable.

The action of the reciprocating parts may be shown by reference to Fig. 2 They start from rest at a, increasing in velocity until the point x is reached, when the crank and connecting rod make a right angle, and the velocity is a maximum. From this point the velocity its decreased until the parts come to rest at the end of the stroke, b. On their return they accelerate from b to x and retard from x to a, thus completing one revolution of the crank.

To accelerate these parts from a to x there is required a definite amount of work to be done on the parts—that is, at x the parts have a given velocity, and hence a given amount of kinetic energy, which energy is abstracted from the expanding gases while the piston travels from a to x. There is then less horizontal pressure felt on the crank pin than there is on the cylinder head. After passing x the reciprocating parts lose velocity or are retarded by the action of the crank, and a pressure on the pin is felt, thereby assisting the pressure of the expanding gases to do work. The amount of work given out by the parts in coming to rest is exactly equal to the amount absorbed by the acceleration in the early part of the stroke. This operation causes an unbalanced pressure on the cylinder head from a to x, tending to push the engine and all connected with it to the left, and an unbalanced pressure on the crank pin from x to b, tending to push the engine and carriage to the right. On the return stroke the piston is not urged by the pressure of exploded gases, but is accelerated from b to x by a pressure from the crank pin, and in retarding from x to a there is a pressure on the crank pin in the opposite direction, which pressures are again unbalanced and tend to shake the engine.

The actual number of foot-pounds necessary to bring the parts up to speed may be calculated by the formula $\frac{W V^2}{2 g}$ in which W is the weight of the reciprocating parts, V is the maximum velocity of the parts and g the force of gravity, or 32.2. Or we may compute it by integrating the area a x d, Fig. 2, which is a graphical representation of the pressure required at any point of the stroke to keep up the acceleration, the area below the horizontal being the work extracted from the gases in accelerating the parts from a to x, and the area above the line being the amount of work given back in retarding the parts from x to b. This work, which is 59.6 foot-pounds, represents the unbalanced effect of the reciprocating parts. We have then the following conditions:

Fig. 2.—From h to e, 59.6 foot-pounds of work, tending to push the carriage to the left; from e to f, 59.6 foot-pounds of work, tending to push the carriage to the right; from f to g, 59.6 foot-pounds of work, tending to push the carriage to the left, the total effect of which would be:

From g to e, 119.2 foot-pounds, tending to push carriage to left; from e to g, 119.2 foot-pounds, tending to push carriage to right. As this work is applied in 1-20 second and is reversed 20 times per second, we feel the effect in a series of violent vibrations.

Of this 119.2 foot-pounds of work, one-half is used in stopping a previous vibration and one-half in producing a vibration in the opposite direction, so that the amplitude of the vibration will be that due to the expenditure of one-half that amount of energy—in other words, the carriage must move far enough at each vibration to absorb 59.6 foot-pounds of energy, or $\frac{59.6}{1,000}$ = .0596 ft., or about .7 in., should the carriage be out of balance horizontally, as ours is. On the other hand, if it were out of balance vertically, as this carriage would be with a counterweight opposite the crank pin, there would be a similar vibration in a vertical direction.

These movements produce a complication of results that, it is needless to say, no carriage could possibly withstand.

At different speeds the results might be somewhat different, depending to a great extent on the design of the motor. If we have a variable speed motor with an explosion at regular

intervals, the tendency of the reciprocating parts to shake the vehicle will decrease as the square of the speed—that is, at half speed the tendency will be only one-fourth as great. The effect of the unequal pull of the motor will vary almost in the same proportion; hence in this case the comparison will be the same at all speeds. But should the motor be one which runs at constant speed, with hit-and-miss governor and gears for changing the speed of the carriage, the effect will be materially different. The engine speed being constant, the tendency to shake due to this cause will be constant at all speeds, and the effect of the unequal pull of the motor will be aggravated at low speeds, for the reason that the explosions will come at greater intervals and consequently cause greater fluctuations of speed; but the tendency to lift the front wheels will not be more intense, since we have considered the effect of a maximum explosion.

We may now draw our conclusions as to the relative value of these disturbing forces.

A motor of the last named type does without doubt produce a jar due to the explosion which may cause some discomfort to the rider, especially at low speeds or when starting, whereas the unbalanced parts produce an effect which is always there.

The desirable qualities in a motor for carriages should be: An engine which is as nearly balanced a machine as is possible; an engine with as few parts as possible; an engine the speed of which is under the control of the driver, and an engine with as nearly constant tangential pressure or twisting moment as may seem advisable.

We have many engines which contain some of these qualities, but they are generally at the expense of others. For instance, of the many kinds of balanced motors there are few which do not attain this end by the addition of many parts, such as extra cranks, connections, pistons and gears, all of which add both to the first cost of the vehicle and to the cost of maintenance. If these parts are necessary, the end attained is worthy of their use; but if the same end can be attained by less parts, the motor of this type is the more desirable machine. An engine whose speed could be regulated at will would make possible any carriage velocity desired without the use of much of the intermediate gearing necessary with constant-speed motors, besides lowering the weight and first cost of the vehicle.

To obtain even an approximately constant tangential pressure would require a motor with cranks set quartering and receiving four impulses per revolution. This would necessitate eight four-cycle cylinders or four two-cycle cylinders, the cost of either type of which would be too great for practical usage or to pay for the end attained.

Explosive Motor Data.

By R. I. Clegg.

The manufacture of explosive motors for vehicle use is confined to comparatively few firms. It is true that many mechanics are not only cogitating over the pros and cons incidental to the production of really useful oil engines, but are actually building very creditable machines that to some degree of success solve the problems incidental to the production of an efficient explosive motor. To build one or even several of these is not manufacturing in the modern acceptation of the term, and there will be considerable experiment and exchange of ideas prior to the transition of the engine builder to the more advanced stage.

Right here he will find difficulty. Most of the books professing to treat fully upon the subject are devoted in the main to disquisitions upon the general theory and afford little or no help upon practical design; such help, for example, as is to be found in many text books treating upon the steam engine. Theory is not to be despised and one cannot digest too much of it; but the searcher after practical data will often regret that the several able authors have in so few instances applied their store of knowledge to the publication of the complete detailed dimensions of one or more actual working explosive motors.

Successful manufacturers do not care to publish these details for reasons already mentioned, and a goodly portion of my time has been devoted through the columns of The Horseless Age to the task of answering inquiries of this class, and this article is a further contribution along this line.

To the several correspondents who have recently requested particulars as to De Dion and other motors, this article will probably serve their needs and no further reply is at present contemplated.

It will of course be assumed that my work is largely a compilation of data from the efforts of the many, and error is not altogether avoidable. Limiting my field of action to motors designed almost exclusively for vehicles cuts off some avenues of information, and hence involves the likelihood of incorporating some material not easily reconcilable the one with the other.

With this understanding we may take up a modern motor of the explosive type for examination. One of the most important is the De Dion-Bouton motor, and as this is a typical machine we shall consider it in detail. The motive power is furnished by the evaporation of gasoline contained in a vaporizing chamber. The gas is then mixed with air to form an explosive mixture, which is then admitted to the cylinder of the motor, and by explosion at proper intervals exerts pressure on the piston. The general arangement of the De Dion motor is shown in the sketch. To the upper left will be seen the vaporizer (carbureter). The air enters by the tube A and passes between the plate B, and the liquid, taking up in its passage some of the hydrocarbon, the carbureted air then rises and enters the double valve (shown in detail), where it mixes with an additional quantity of air which enters at the opening D, then passing to the motor through the tube E.

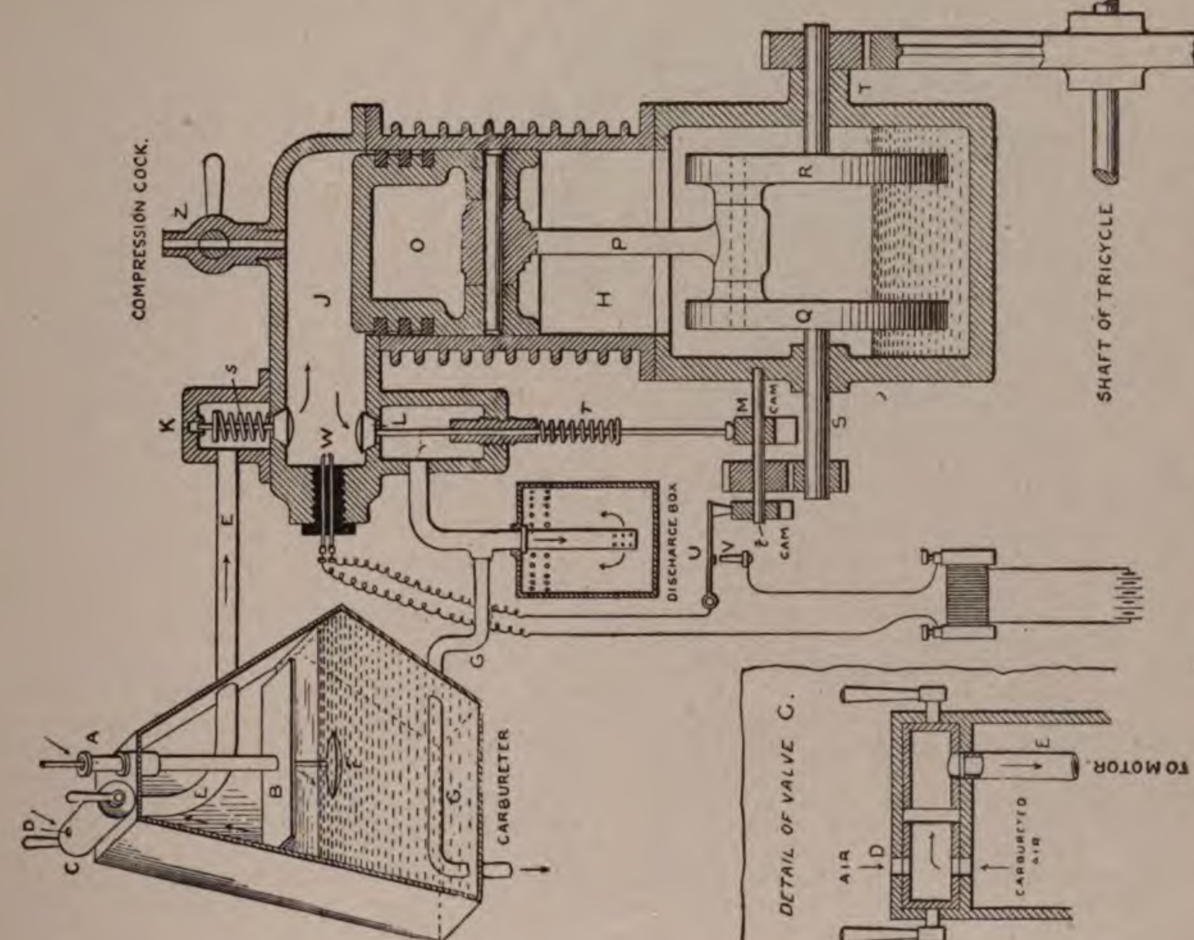
It will be noted that the one lever regulates the quantity and the other lever the quality of the mixture.

The level of the gasoline is shown by the float F, and this also indicates the position of the plate B, which is attached to the tube through which the stem of the float F passes to the exterior. By the evaporation of the gasoline the temperature of the liquid rapidly falls in the vaporizer, and, to restore the heat so lost, a portion of the exhaust gases are sent through G to warm the carbureter. The cylinder H is usually of cast steel, this material permitting a very thin light design. On the authority of M. Baudry de Saunier I submit the following dimension of the ¾, 1¼ and 1¾ h.p. motor cylinders:

Diameter—2.28, 2.44, 2.6 in. respectively—that is, 58, 62 and 66 millimeters. In each size the thickness of the cylinder walls is the same, viz., 118-1000 in., or 3 millimeters.

The stroke was the same in each size, always 70 millimeters, or 2.76 in.

The smaller sizes of this make of motor have radiating flanges to increase the surface and diminish the danger from overheating. These flanges are 17 in number on the ¾ and 1¼ h.p. cylinders, and have a width of 15 millimeters (59-100 in.) and 17 millimeters (67-100 in.) respectively. In the 1¾



SECTIONAL VIEW OF DE DION MOTOR.

h.p. they number 16 and have a width of 19 millimeters (75-100 in.).

On the upper part of the cylinder is the explosion or compression chamber J, with the admission valve K. This inlet valve K is closed by the spring S, but is so adjusted that the downstroke of the piston will cause sufficient suction, after the expulsion of the waste gases, to pull the valve from its seat and admit a new charge from the carbureter.

The exhaust valve L is operated by a rod which engages with a cam, M, at the appropriate instant; at other times the valve is closed by the spring r. The igniting device is at W and consists of an insulating plug and two conductors with adjacent platinum points, having a very small intervening air space. The piston is another light steel casting, with three packing rings, attached to the fly wheels Q and R by the piston rod P. The crank shaft T carries at its outer end a pinion which meshes into the transmission gearing. The other crank shaft S has also a pinion which is in mesh with another of double the diameter, keyed on the cam shaft t, which in its turn operates the two cams; the one on the right opens the exhaust valve once in every two revolutions of the crank shaft, the cam on the left operates the lever arm U, carrying the contact points, see V, of the induction coil, and a spark is caused at W.

The action will be readily understood. When the piston descends it produces a vacuum in the top chamber, by the action of which the valve K opens, admitting the detonating mixture from the carbureter; when the piston rises it compresses this gas and the valve of admission closes. At the instant of the second descent of the piston the cam actuates the lever, making contact with the induction coil, upon which a spark passes, causing an explosion of the gas, which pushes the piston with sufficient force to cause it to pass twice through the same position; when the piston rises after its descent it compresses the residual gases of explosion, and at this instant the cam M lifts the exhaust valve and the gas leaves the motor by the exhaust pipe Y. When the piston redescends, this valve closes and the upper valve opens as before to admit a fresh supply of gas, and so on.

The action of the motor is thus determined by four different periods, which may be characterized as (1) introduction of gas, (2) compression, (3) explosion, (4) evacuation of the products of combustion.

There are several details of the De Dion motor not any too well known even to those familiar with gasoline engines as a class and quite recently some of these distinctive features have been pointed out in a paper read by Mr. Alex. Craig at a meeting of the Cycle Engineers' Institute, England. I am indebted to the Autocar for the following:

With regard to the construction of the De Dion engine, it will be noticed that the fly wheels are inclosed in the crank case, and that bath lubrication is used—i. e., a small quantity of oil is put into the crank case, and being picked up by the fly wheels as they revolve is thrown in all directions, some finding its way into the cylinder to lubricate the piston and gudgeon pin, and some trickling down the walls of the crank case, is collected in cavities specially arranged for that purpose, from whence it drains through the bearings, and returns to the lower part of the crank case. If a slight excess of oil be used it finds another path and gets past the rings and into the combustion chamber, where it causes difficulties with the sparking, and smoke and smell from the exhaust.

The above is one view of the action of the lubricant, but the makers have advanced the opinion that the oil becomes vaporized, and in that form finds its way to every bearing, and from the temperature sometimes attained in these motors one can easily believe that such is the case. The crank and fly wheels are built up on short, hardened spindles, drawn up into tapered holes.

The bearings in all cases are plain bushes, and phosphor bronze is now used in the place of hardened steel. The speed at which these motors are capable of running, viz., 2,000 to 3,000 revolutions per minute, is really astonishing, and the utmost care and skill are necessary in their construction.

Ignition.—One of the most important problems connected with oil motors is ignition, and probably more stoppages and inconveniences may be traced to this source than to any other.

In the first place, let us examine the function of the igniting device. Whether it be tube or electric it is the same, viz., to ignite the explosive mixture thoroughly, and at the right point in the stroke. This point varies for different speeds, so that if the point of firing be fixed, the motor will not be giving its best power except at the speed for which the firing has been arranged. It is, therefore, evident that to be satisfactory the timing of the ignition should be capable of variation. In this respect the incandescent tube without a timing valve is at a disadvantage. The method by which the timing is fixed in the case of tube ignition, as on the Daimler engine, is as follows:

The ignition tubes which are employed to fire the charge are fixed by union nuts to steel nipples, which are screwed into the cylinder wall at a point between the exhaust and admission valves. The size and shape of the passage through these steel nipples materially affects the timing of the explosion. The correct size in a newly designed engine is arrived at, not by calculation, but by brake tests with nipples of different sizes, from which the best is selected.

Of the various forms of electric ignition, that used on the Benz car is an example of the oldest and most common type. The De Dicn ignition is an interesting variation of it.

In the former a set of accumulators, giving 4 volts, is used. One terminal of these is conected to an induction coil of the ordinary form, with a magnetic interrupter. The other lead from the battery is connected to a wiper, which bears on what is practically a single bar commutator on the lay shaft of the engine, the bar being grounded to the shaft. The other terminal of the primary winding of the induction coil is also grounded, so that every time the commutator bar passes the wiper the circuit is completed through the frame, and the induction coil is set in action. One terminal of the high tension winding is grounded, and the other is connected by a thoroughly insulated wire to the ignition plug of the engine. This plug consists of a rod of porcelain passing through a gland and stuffing box, in which it is held by asbestos packing. The porcelain has a metallic core, terminating inside the cylinder in a point, usually of platinum. In close proximity to this is another platinum point, projecting from the shell of the stuffing box, and, therefore, grounded to the frame. When the primary winding of the induction coil is excited by the intermittent current from the batteries, a high tension current is induced in the secondary winding, of sufficient voltage to spark across the fixed platinum points in the cylinder and fire the charge.

In order to time the spark the wiper which bears on the commutator on the lay shaft is mounted on an insulated rocker, moved by a rod from the driver's seat. This method of ignition was used on the earliest gas and oil engines and is very effective, especially where the speed is comparatively low.

It may be useful to describe the action of the induction coil more fully in order that the difference of the De Dion system may be clearly seen. A bundle of soft iron wire is used as a core, and this is wound with a few layers of insulated copper wire of comparatively low resistance. Over this primary winding is wound layer after layer of very fine silk covered wire to form the secondary coil. The low tension current from the battery is passed through the primary coil magnetizing the iron core. The high tension current is taken from the secondary winding to the ignition plug.

The current is only induced in the secondary coil when that in the primary is turned on or off sharply, one spark being produced at each operation. To assist the commutator and wiper in this respect a device is fitted to the coil known as a trembler, which has the effect of producing a stream of sparks each time the circuit is completed through the wiper.

The trembler consists of a steel spring with a small block of soft iron at its extremity immediately opposite the end of the iron core of the induction coil. At a convenient point in its length a platinum rivet is fixed in the spring, and this bears on a platinum-pointed adjustable screw, carried in a brass column, projecting from the insulated base of the coil. In its normal position the soft iron block on the end of the spring is a short distance away from the head of the induction coil core, and the platinum rivet on the spring bears on the point of the screw. The connections are so arranged in the coil that the current from the batteries passes through the platinum-pointed screw, along the spring, and then through the primary winding of the coil; but this action magnetizes the core of the coil, attracts the iron block on the spring, and draws the platinum rivet away from the point of the screw. This breaks the circuit, and causes the iron core of the coil to lose its magnetism, allowing the spring to fall back on to the screw, remaking the circuit. The same action takes place over and over again in rapid succession, so long as the current from the battery is available—i. e., so long as the wiper is on the commutator bar. Each make and break of the trembler on the induction coil brings a spark, so that at slow speeds a stream of sparks is obtained, whose duration depends on the time the wiper is in contact with the commutator bar. If the current from the batteries was simply passed through the primary coil, without being interrupted, no effect would be produced in the secondary coil, except the single spark when the current was turned on, and another when it was turned off. By keeping these facts as to the action of the induction coil carefully in mind, we can see at once wherein the principle of the De Dion ignition differs. De Dion uses a coil which has no trembler—indeed, it is to all intents and purposes an alternating transformer. As an equivalent to the vibrator on the ordinary coil he uses a contact blade mounted on an ebonite rocker. The

fittings and connections on this ebonite rocker are exactly the same as on the ordinary induction coil, if we consider a wedge-shaped steel nose in place of the soft iron block and a cam disk with a single notch in place of the core of the induction coil. This notched cam disk is keyed on to the second motion shaft of the engine, and each time the wedge block on the end of the spring falls into the notch it vibrates, or is supposed to vibrate, producing the trembling effect and succession of sparks which the ordinary induction coil gives. It will thus be seen that the contact blade is intended to serve the dual purpose of a commutator switch and a trembler. I have said that it is supposed to perform the latter function, and great claims have been made for its efficiency and novelty in this respect. My experience, however, leads me to believe that in the majority of cases it is nothing more than a switch, and that there is only one make and one break, causing two single sparks in rapid succession at each revolution of the cam shaft, and certainly very satisfactory results are obtained under these conditions. The apparatus would be more efficient as a switch if it had bigger contact surface, and if the latter were arranged to be out of reach of the oil which leaks through the bearings. The induction coil is provided with a condenser of tin foil and paraffined paper, which is connected as a strut across the primary coil terminals.

In conjunction with either of these forms of electric ignition a generator may be used in place of the battery, and in some cases a small dynamo is employed in addition to accumulators, the latter being used to supply the current for starting, and as soon as the speed of the engine rises the dynamo is switched on.

To those who have some acquaintance with the French language the ample volume of M. Saunier on the "Automobile" gives a popular description of the De Dion and Benz motors at some length. It may here be stated that the main dimensions of the 3-h.p. Benz motor are: Diameter, 100 millimeters, or 3.94 in.; stroke, 120 millimeters, or 4.72 in., the normal speed being given as 300 turns to the minute.

For general convenience it is best to incorporate the dimensions of other modern machines as far as they are to be had for the purpose, and in this work I am greatly indebted to the Locomotion Automobile for the details of the following motors: Bouchet, Touriste, De Dion and Delahaye, and the Amiot-Peneau, etc.:

MOTEUR AMIOT-PENEAU.

This motor is similar to the Cyclops motor of Daniel Auge and is built by the firm of Amiot & Peneau, Paris. It is used in the power for a carriage system of this company, and this particular motor was applied to a family omnibus.

The motor has two vertical cylinders, cooled by a water circulation. Provision is made for electric ignition as well as the incandescent tube, this last presenting the special arrangement of the Cyclop motors, viz., a single burner heating two tubes. The results here given have been obtained with the electric ignition only. Other trials will be made eventually if possible with hot tube ignition, as well as with the two ignition systems acting at the same time. The trials were made with the muffler in place.

	MM.	Inches.
Diameter of each cylinder	100	3.94
Stroke of pistons	160	6.3
Diameter of inlet valves	35	1.38
Useful diameter of the above	33	1.3
Diameter of the exhaust valves	36	1.42
Useful diameter of the above	32	1.26

In a series of brake tests at 752 to 780 turns per minute, the results were from 7 to 8 h.p.

MOTEUR AL. DUMAS FILS, PARIS.

Motor has two horizontal cylinders, cooled by a circulation of water. Electrical ignition was employed.

	MM.	Inches.
Diameter of cylinders	103.5	4.07
Stroke of pistons	125	4.92
Outside diameter of exhaust valve	37	1.45
Useful diameter of exhaust valve	31	1.22
Outside diameter of inlet valve	37	1.45
Useful diameter of inlet valve	31	1.22
Lift of inlet valve	4	.16
Lift of exhaust valve	8	.31
Inside diameter of exhaust pipe	31	1.22
Inside diameter of inlet pipe	30	1.18

In the brake test without muffler, from 700 to 1,225 revolutions per minute, 7 to 7¾ h.p. was developed; with the muffler, however, but 6 1-10-h.p. was obtained at 1,012 revolutions per minute. It is a matter for regret that dimensions of the particular muffler used are not available.

MOTEUR DE DION-BOUTON.

This machine was nearly new; a vertical cylinder, cooled by flanges; electrical ignition. The trials were made with a De Dion-Bouton carbureter.

	MM.	Inches.
Diameter of cylinder	66	2.6
Stroke of piston	70	2.75
Outside diameter of exhaust valve	30	1.18
Useful diameter of exhaust valve	25	.98
Outside diameter of inlet valve	30	1.18
Useful diameter of inlet valve	25	.98

Capacity of combustion chamber in cubic centimeters, 92, or 5.6 cu. in.

Without the muffler, at 1,752 revolutions per minute, 1.57-h.p. was shown on the brake, and at 1,360 revolutions per minute, 1.3-h.p.

Applying the muffler, 1,426, 1,580, 1,393, 1,326 and 1,436 revolutions per minute, obtained 1.4, 1.32, 1.36, 1.39 and 1.23 h.p. respectively.

MOTEUR DELAHAYE.

This motor was on a Delahaye carriage which was submitted to the engineers of La Locomotion Automobile by the owner, M. E. Chale, of Paris. The motor has two horizontal and parallel cylinders, electrical ignition and was cooled by a circulation of water. The weight of the empty carriage is 1,200 kilograms, or 2,644.8 lbs.

	MM.	Inches.
Diameter of each cylinder	110	4.43
Stroke of pistons	160	6.3
Outside diameter of each exhaust valve	43	1.69
Useful diameter of each exhaust valve	35	1.38
Outside diameter of each admission valve	43	1.69
Useful diameter of each admission valve	35	1.38
Lift of admission valves	4	.157
Lift of exhaust valves	8	.315

At tests at the following speeds: 687, 774, 820 and 893 revolutions per minute, the following horse-power was developed: 10.85, 10½, 9.3 and 9.3, respectively.

MOTEUR "LE TOURISTE"—BOUCHE SYSTEM.

This motor was entered by the builder, M. Mouin. The engine has two horizontal parallel cylinders, electrical ignition, cooled by water circulation. The exhaust is controlled by an eccentric. The carbureter employed in the tests was devised by M. J. Bouchè. For the first three tests benzo-motor petrol (680 density) was supplied to the carbureter. In the last test, however, a new and heavier hydrocarbon was employed. Each

test was obtained after a quarter of an hour's run under the brake.

The series was made with the muffler in place.

	MM.	Inches.
Diameter of each cylinder	90	3.54
Stroke of piston	70	2.76
Diameter of admission valves	35	1.38
Diameter of exhaust valves	28	1.1

With benzo-motor petrol (680) and at 680, 630 and 633 revolutions per minute the results were: 5.04, 5.86 and 5.6 h.p. respectively. When supplied with the heavier oil (880) and turning at 622 revolutions, 5.77-h.p. was recorded.

MOTEUR DE DION-BOUTON.

This motor, supplied by M. Massion, was formerly a 66 by 70 millimeters, changed into a 70 by 70 millimeters.

Single, vertical cylinder, electrical ignition, cooled by flanges. Benzo-motor petrol (680) used in trials.

	MM.	Inches.
Diameter of cylinder	70	2.76
Stroke of piston	70	2.76
Outside diameter of each valve, admission and exhaust	30	1.18
Useful diameter of each of these valves	25	.98

Number of turns per minute, 1,564, 1,686 and 1,650, and the horse-power, 1.32, 1.72 and 1.6.

MOTEUR GOBRUN-BRILLIE.

This machine was engaged by Societe des Moteurs Gobrun-Brillie, of Boulogne-sur-Seine.

This has two vertical cylinders and four pistons, the explosions being produced between the two pistons, the two upper pistons having a shorter stroke than the two lower pistons. The carbureter, or rather the oil distributer, has a special arrangement. It varies the quantity of petrol entering the cylinders, the governor acting upon this distributor. Electrical ignition and cooling by water circulation.

The tests were made with benzo-motor petrol or with the heavier petrol, the motor having always the muffler in position.

	MM.	Inches.
Diameter of each cylinder	80	3.15
Stroke of the lower pistons	80	3.15
Stroke of the upper pistons	60	2.36
Total stroke of each cylinder	140	5.51

With 880 petrol and 823, 837, 696, 866 and 674 revolutions per minute the horse-power was 5.94, 6, 5.8, 6.25 and 5.6, while with benzo-motor petrol (680) and 849 and 870 revolutions per minute 6.13 and 6.2 h.p. were recorded.

MOTEUR BUCHET.

This was enrolled by M. Buchet, of Paris. The motor has a single vertical cylinder, electrical ignition, and was cooled by a circulation of water. The trials were made with a petrol of 700 density. The carbureter was on the Buchet system.

	MM.	Inches.
Diameter of cylinder	90	3.54
Stroke of piston	130	5.12
Diameter of admission valve	32	1.26
Lift of admission valve	4	1.57
Diameter of exhaust	32	1.26
Lift of exhaust	6	.24

Turns per minute, 850, 867, 867, 900 and 838, and resulting horse-power, 3.4, 3.73, 3.5, 3.3 and 3.45.

MOTEUR À CULASSE BUCHET.

This was also entered by M. Buchet. The motor was a De Dion altered over—the cylinder changed and opened to the dimensions 80 by 80 millimeters. The Buchet combustion, or compression, chamber has already been mentioned in The Horseless Age.

Motor has a single vertical cylinder cooled by flanges and electrical ignition. The test was made with an oil of 700 in a pulverizing carbureter.

	MM.	Inches.
Diameter of cylinder	80	3.15
Stroke of piston	80	3.15
Diameter of admission valve	30	1.18
Lift of admission valve	4	.157
Diameter of exhaust valve	30	1.18
Lift of exhaust valve	4	.157

At the following revolutions per minute: 1,660, 1,500, 1,500, 1,600, 1,688 and 1,700, the following horse-power resulted: 3, 2.5, 2.65, 3.3, 3.3, 3.

LE VOITURE RAOUVAL.

This carriage was submitted for examination by the Societe de Mecanique Industrial d' Anzin (Nord).

The carriage weighed 1,100 kilograms, or 2,424.4 lbs, the weight on the rear axle being about 700 kilograms, or 1,542.8 lbs. The motor, patterned after the Pygmee of Leo Lefebvre, has two vertical cylinders, electrical ignition, and cooled by a circulation of water. Each cylinder is 110 millimeters in diameter and 150 millimeters stroke (or, in inches, 4.33 by 5.9); the valves have a diameter of 30 millimeters (1.18 in.), with a lift of 5 millimeters (.196 in.) for the admission valve and 7 millimeters (.275 in.) for the exhaust.

The engineer of the manufacturing company declared that under favorable conditions he had obtained from 8 to 8.4 h.p. at 700 revolutions per minute from this motor. The carriage has traveled over 10,000 kilometers (say 6,200 miles).

Trial was made on slow speed. Mean number of turns per minute, 82, a speed corresponding to 7.4 kilometers to the hour (say 4.79 miles).

At this speed the brake indicated 5-h.p.

It has been hoped that the several particulars I have gathered in this issue could have been supplemented by a sufficient number to have rendered it an easy task to produce some easily applied formulæ or rules for the design of explosive motors in general. The difficulty already mentioned has deferred this, but I intend, as soon as practicable, the reduction of this and other material that I may obtain to a more readily handled form than the present.

If a convenient unit be taken, as, for example, the capacity or the volume swept through by the piston at each stroke, we can then assign the value of the other cylinder details on section paper in a very handy form. Due consideration should be given in such a case to speeds and other varying factors, and in the space at my disposal and for the reason already assigned, I must leave this for the present.

In the recently published "Les Moteurs à Explosion," by Geo. Moreau (1900), several tables are given of actual results obtained by careful experimenters. Herewith I submit two, the one obtained at a test at Berlin, the other dealing with the later French motors. As elsewhere in this article I have changed the figures to conform to our system of inch measurement, to two places of decimals:

Motor	Diameter	Stroke	N. H. P.	R. P. M.	B. H. P.
Daimler	6.89	11.02	4	240	2.25
Otto	6.1	9.45	4	230	4
Durkopp	6.89	11.02	4	230	4.46
Hille	5.12	9.05	3	240	3.12
Koerting	6.89	10.83	4	220	4.15
Robey	6.02	9.01	2	300	1.82

The petrol employed was of a density of 0.797, and, commencing with the Daimler, the consumption of oil was 609,

575, 585, 450, 600 and 1,190 grammes, respectively, per horse-power hour.

It is not easy by any means to determine just how the Durkopp and the Daimler show such diverging results with so closely akin dimensions. I do not have a complete description of the Durkopp motor. The Daimler, as one of the pioneers among vehicle motors, is worthy of a brief description. It was first exhibited in 1889, the later designs having two cylinders over the crank shaft, and the connecting rods work upon one crank pin set between heavy crank disks. The connecting rods and crank are incased in an air tight casing, and an air valve admits air to this casing as the pistons rise. The gas and exhaust valves are at the upper end of the cylinders, the former being automatic and the latter lifted by the cam. In the center of each piston a valve is placed to admit air from crank casing to combustion chamber. The motor is governed by acting upon the exhaust valve. Should this be held open of course there could be no vacuum in cylinder to allow the opening of the automatic valves.

The working process will now be seen to be as follows: Upon the down stroke the one cylinder expands its burning charge, while the other draws in gas, and at the same time passes air from the crank casing into the working cylinder through the valve in the piston. On the return stroke one cylinder exhausts, while the other compresses. Although an Otto cycle motor, an impulse is given every revolution.

Thanks to the labor of M. Moreau, I am enabled to submit a table showing the leading dimensions of some French and German vehicle motors not included in the preceding list:

Motor.	Cylinders.	R. P. M.	B. H. P.	Diameter.	Stroke.
De Dion-Bouton	1	1,350	1.25	2.44	2.83
Cosmos	1	1,200	2.50	3.23	3.54
Daimler-Levassor	2	750	3.50	2.95	4.72
Phenix-Levassor	2	750	4.25	3.15	4.72
Pengeot	2	750	4.90	3.31	4.96
Benz	1	480	5	5.71	7.08
Duplex	2	600	6	6.06	4.72
Bollee	2	660	6.50	3.74	6.30
Tenting	4	250	16	5.51	8.66

It has seemed decidedly preferable to give actual working dimensions where they were obtainable rather than attempt to copy or even construct formulæ at this stage of the industry. The formulæ are not so readily acceptable, and there is a disparity in results from the formulæ given by several authors that, to say the least, must prove perplexing. Take, for example, the horse-power that a cylinder of a certain size may represent. Evidently a rule which could take cognizance of the four elements, speed, stroke, diameter and horse-powers, and supply any one of these if the other three were obtainable, would be very useful. Certainly other factors would come in for consideration; but the effort to avoid these and yet produce fairly accurate conclusions is undoubtedly commendable, and the attempt has been made. Note the results:

Suppose $d =$ the diameter of the cylinder.
$h =$ the stroke of piston.
$n =$ the number of turns.
$N =$ the horse-power.

M. Hospitalier gives

$$N = (3.49 \text{ to } 4.36)\, n\, h\, d^2.$$

M. Witz suggests

$$N = 2.8\, n\, h\, d^2.$$

M. Ringelmann proposes

$$N = 3.37\, n\, h\, d^2.$$

MM. Vigreux, Milandre and Bouquet agree upon

$$N = 3.22\, n\, h\, d^2.$$

While M. Moreau declares that the following is satisfactory:

$$N = \tfrac{1}{3}\, n\, h\, d^2.$$

In this connection, viz., horse-power, one may derive some little mnemonic aid by the word "leap," the indicated horse-power being determined with the help of the diagram, as follows:

Let $I =$ the indicated horse-power.
$L =$ the length of stroke in feet.
$E =$ number of explosions per minute.
$A =$ area of cylinder in square inches.
$P =$ mean pressure per square inch on the piston.
Then $I =$

In Low's very useful "Mechanical Engineer's Pocket Book' a number of rules and data are given relative to gasoline engines. Wherever it is possible in the case of this or indeed any other text book, it is well to compare the result with some actual motor if this is at all possible, because actual practice in light motors for vehicle use has a strong tendency to modify the old rules. The trunk piston was to have a length equal to twice the diameter; but many fast-running small motors are much shorter than this rule would allow. The whole matter of design, except so far as it may be deduced from data applicable to the steam engine, is rather a matter of principle and good judgment than any generally accepted formulæ. In one of his criticisms the late Mr. D. Clerk has so laid down the general features of successful gas engine design that I shall here attempt in a brief form to collect them:

"Any increase in the volume of the exhaust products causes loss of economy; a small proportion does little harm, but a large volume of exhaust heats the entering charge and so raises the temperature of compression. Premature ignitions are also caused by the compression of a charge mixed with hot exhaust. Designers now endeavor to have the exhaust products expelled by having a very free exit for the gases. To get the best possible results from a given volume of explosive mixture it should be compressed into a combustion chamber having the minimum of port capacity communicating with the inlet and exhaust valves. Ports act as condensers for the flame of the explosion, and rapidly cool the ignited charge at a time when it least bears cooling. To gain the greatest advantage from high compressions the whole of the compressed explosive mixture should be contained in one space—that is, a space which is not divided into smaller separate spaces. Ports should be avoided if possible and the flame should never be caused to flow through a narrow space into a wider one. The compression space should be as nearly cubical or spherical as possible."

Pipes of generous radii, say 6 in., are advisable in connections, and whatever retards either the passage of the gases to and from, as well as the propagation of the flame in, the cylinder must be avoided. In another article I have given details of a practical explosive motor, which may be taken as a continuation of this article.

Dr. O. P. Sook, Newark, O., has recently purchased a steam carriage, which he is arranging to keep back of his house in a steam heated structure. The gas jet will also be kept burning under the generator and the water kept hot, so that the machine will be ready at a moment's notice.

An Explosive Motor in Detail.

By R. I. Clegg.

The explosive motor described in this article has been given as a part of a motor cycle in the English Mechanic, and as it well illustrates many important features in a practical and easily understood form. I have redrawn the original sketches and have paid due attention to those portions of the description that in transposition might give rise to error from the divergence of the shop nomenclature in the two countries.

It should be understood that the drawings are no fancy sketches, and that the machine has been built and tested with good credit to the designer, whose name is not for publication, I regret to state; and it may be assumed with safety that if the directions are carefully followed the machine cannot fail to be a success; but if carelessly built the chances are it will not work at all, or, if it should move, will fail to give any power worthy of the name. The piston and rings, while easy, must fit well, so that there shall be little or no leakage past them. The power of the motor depends to a very great extent upon the compression of the charge before ignition; therefore, it will easily be understood that a badly fitted piston and rings will not allow the compression to reach so high a value as it should do. The general appearance and action is similar to the De Dion-Bouton motor I have described elsewhere in this issue. The normal speed will be 1,000 revolutions per minute, which, with a stroke of 3¾ in., gives the moderate piston speed of 625 ft. per minute. The compression depends upon the amount of explosive mixture admitted to the cylinder during the charging stroke. With the full allowance, this can reach 60 lbs. per square inch, provided the fit of piston rings and valves is good. With the full amount of compression and the ignition arranged to take place at the proper point, the brake horse-power at 1,000 revolutions will be 1¾.

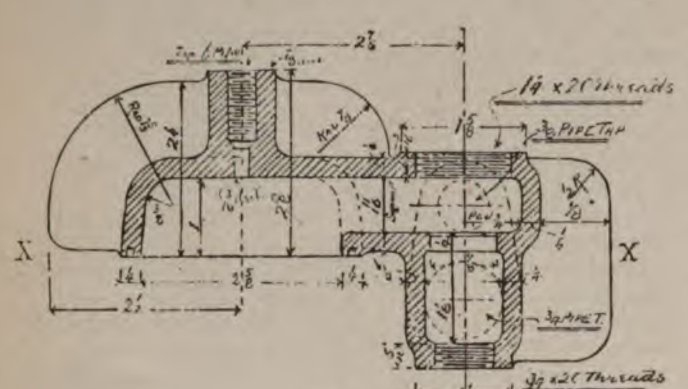


FIG. 1.

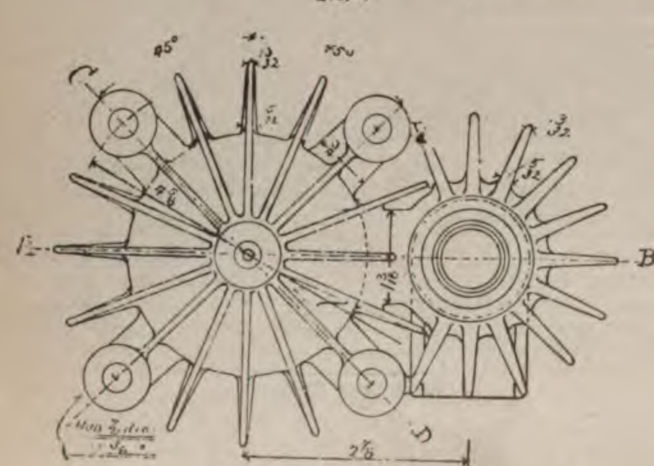


FIG. 2.

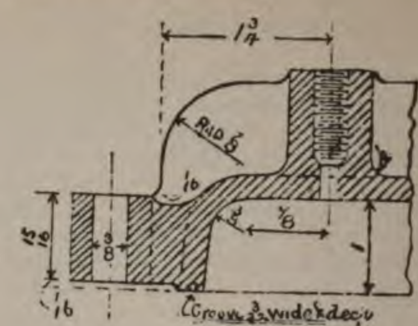


FIG 3

Great care should be taken with the patterns and allowance made for contraction and finish over the sizes given.

THE CYLINDER HEAD.

Fig. 1 shows this in vertical section on the line A B of Fig. 2. The flanges taper from 5-32 to 3-32 in. The hub on top is for the compression relief valve. The cylinder head is intended to be close grained cast iron. Fig. 3 gives the dimensions of stud holes, etc., for holding down in place. Fig. 4 is the exhaust valve guide, of wrought iron, though a casting may serve almost as well. After this latter is screwed into place a dowel pin or screw is put through bottom of valve box between two of the ribs to prevent the guide from working loose. The hexagon is left square for end of spring.

THE CYLINDER.

A vertical section of this is given in Fig. 5, on line A B of Fig. 6. This line A B runs at right angles to the line C D. Note on the plan the cutting away at X X, Fig. 6, to allow cylinder studs to pass, and at Z, Figs. 5 and 6, for valve box

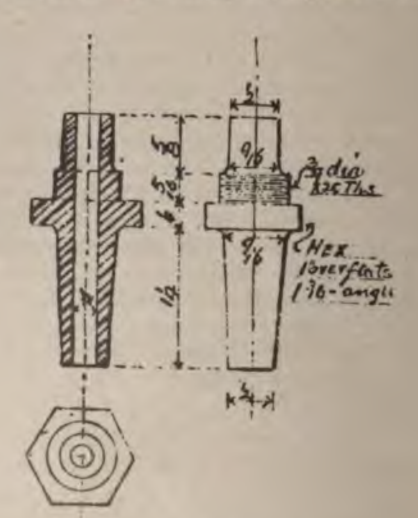


FIG. 4.

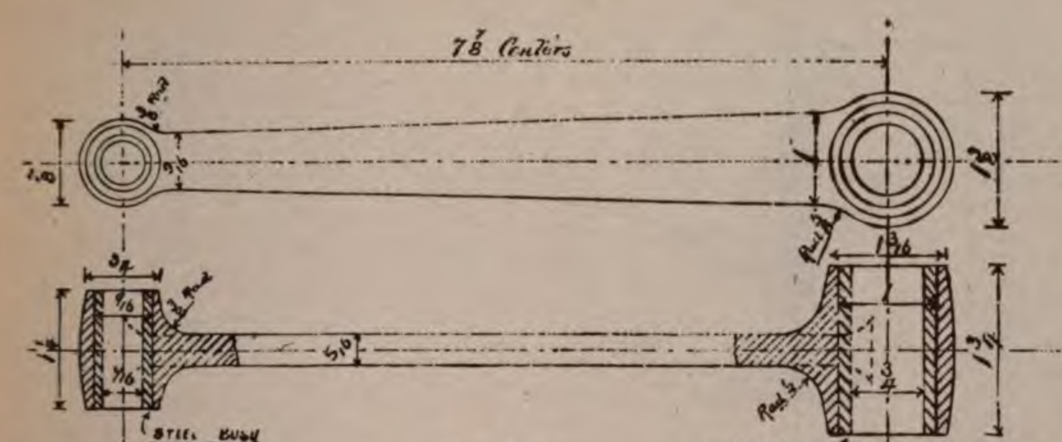


Fig. 7

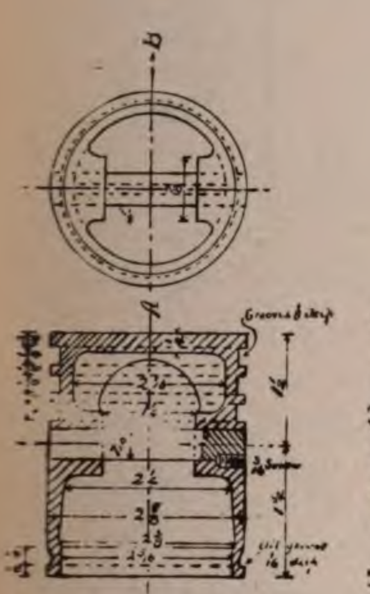


Fig. 8

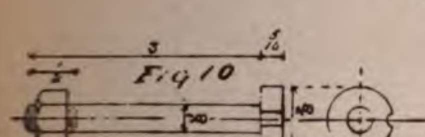


Fig 10

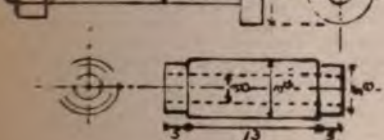


Fig 9

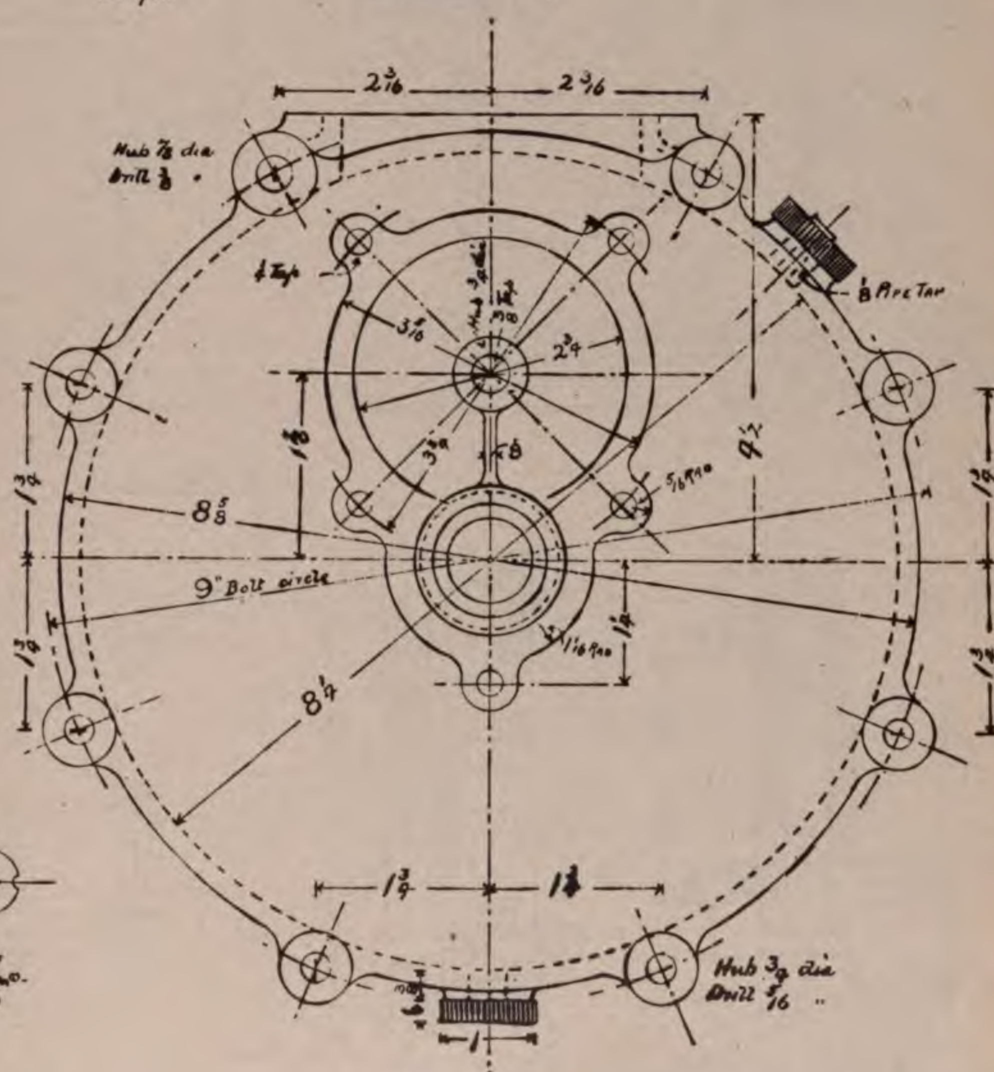


Fig. 11

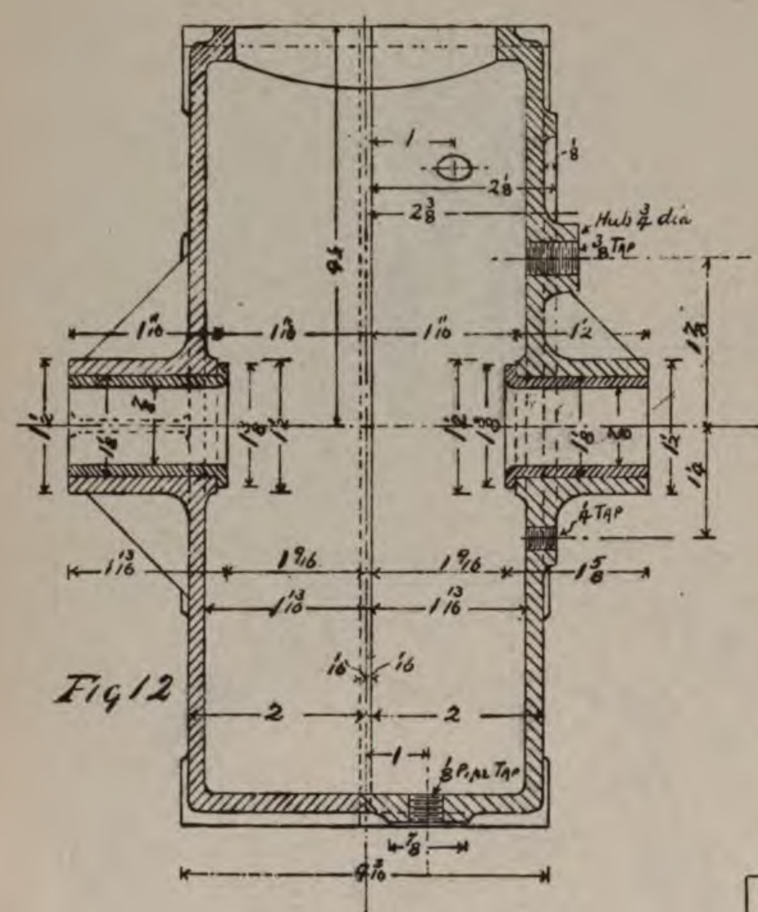


FIG 12

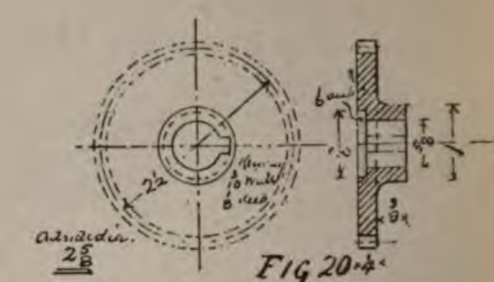
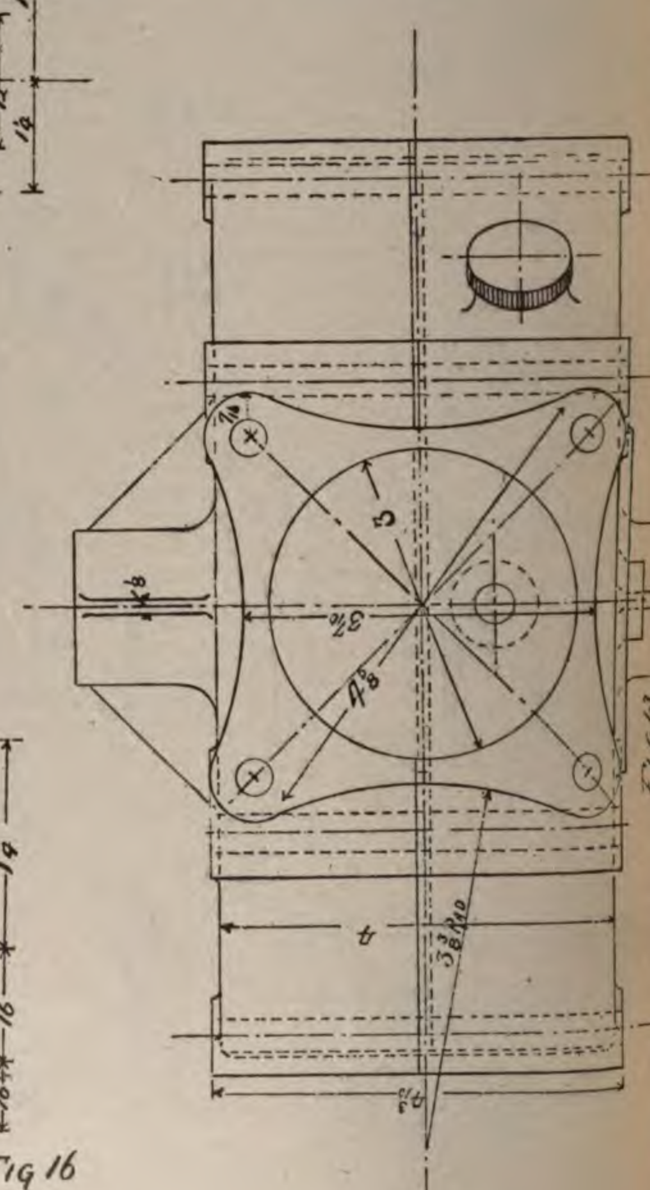


FIG 20



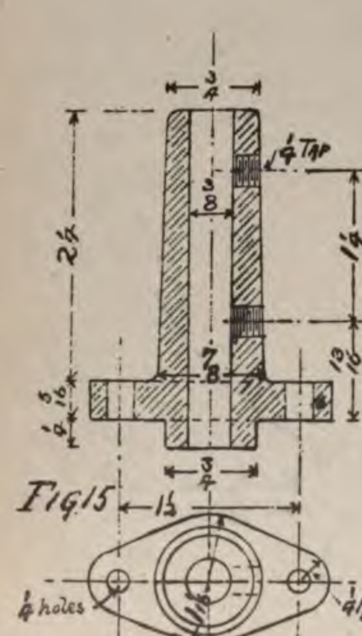


FIG 15

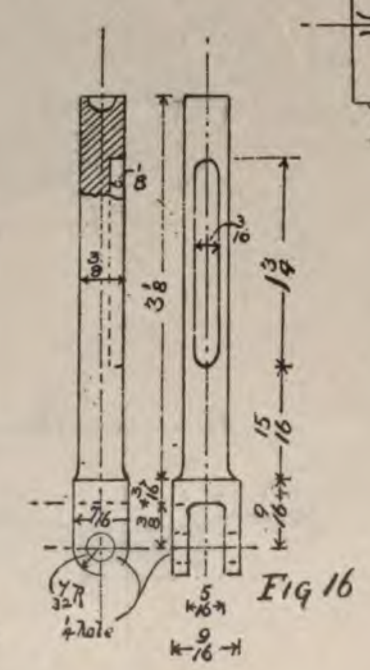


FIG 16

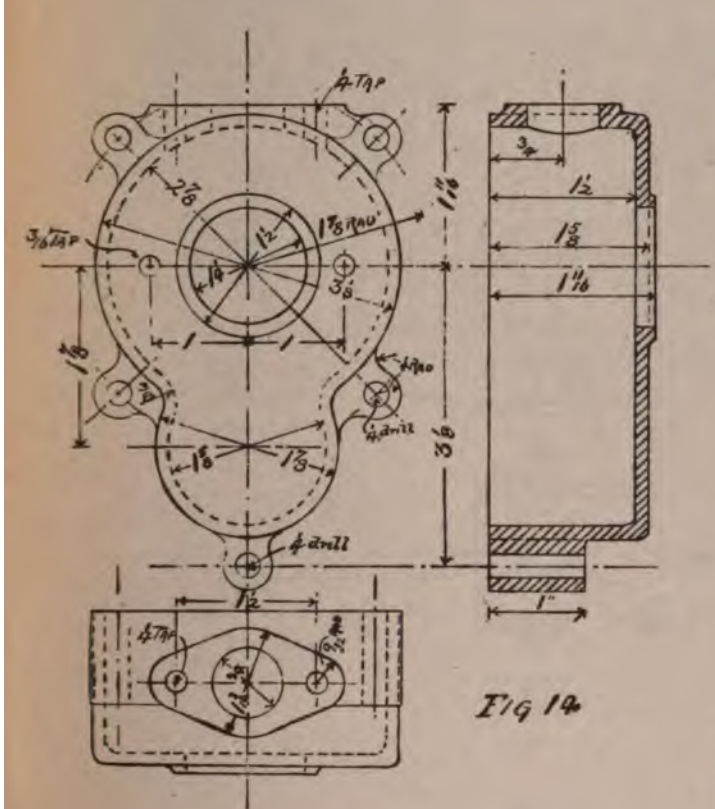


Fig 14

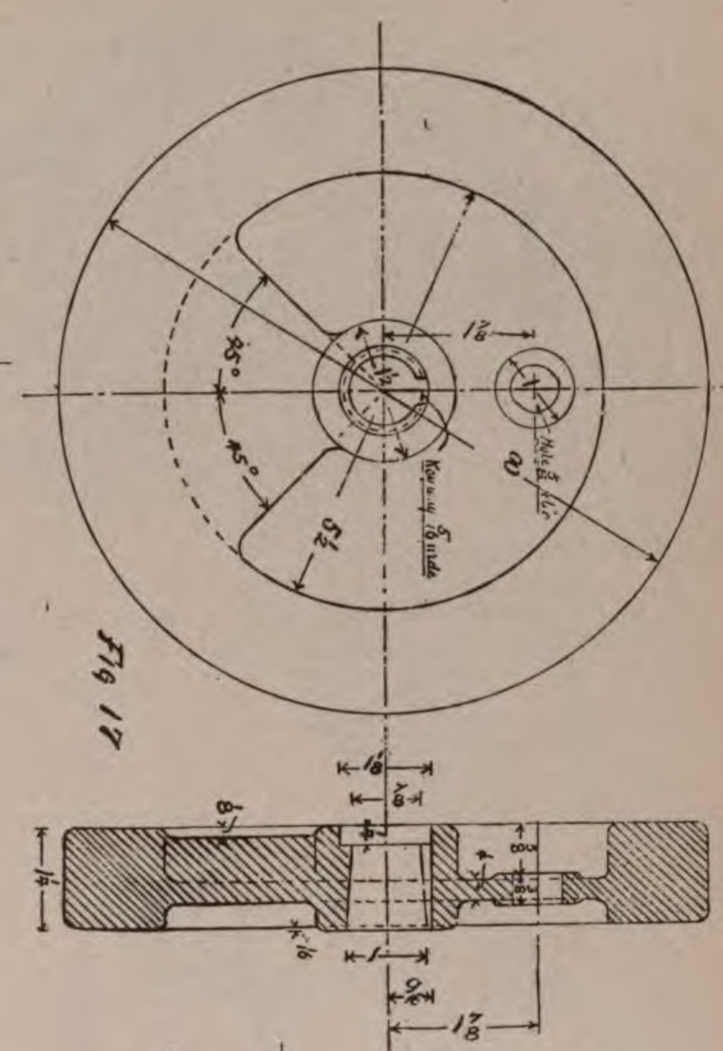


Fig 17

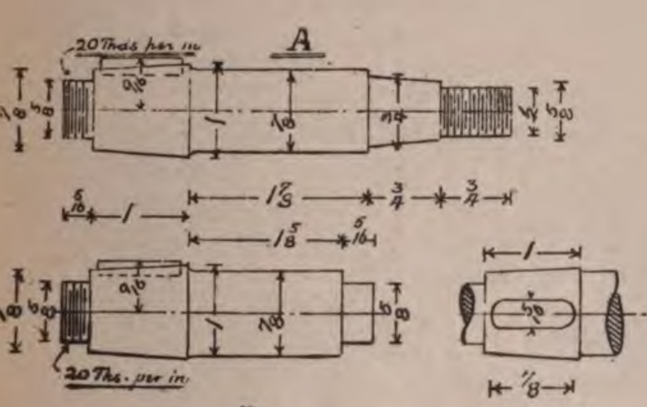


FIG. 18

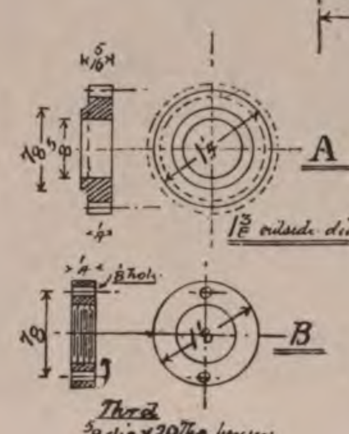


Fig. 19

and exhaust valve guide, spring and rod. The four top ribs are cut away to the larger radius, and the remainder to the smaller radius shown in Fig. 6

PISTON AND RINGS.

A vertical section and plan are given in Fig. 8. The piston should be turned to such a fit that it can easily be pushed through cylinder by hand, with little or no force. The piston pin is made of milled steel, and when the dowel screw has been fitted the pin should, be case hardened.

The piston rings are turned from a cast iron open-end cylinder, 2⅞ in. outside diameter and 2¼ in. inside. Turn the rings 2¾ in. outside and 2½ in. inside diameter and cut them

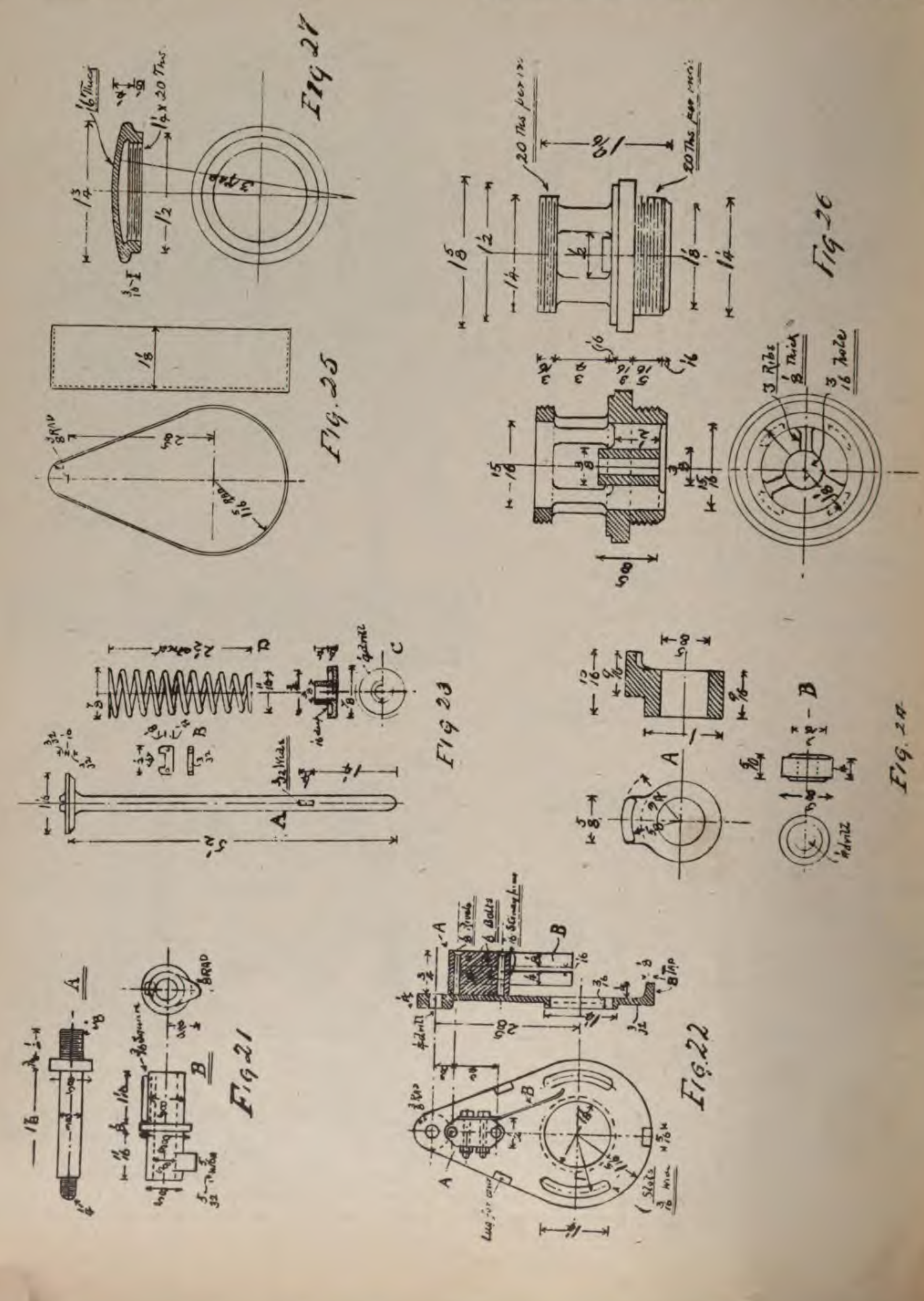


Fig. 21

Fig. 22

Fig. 23

Fig. 24

Fig. 25

Fig. 26

Fig. 27

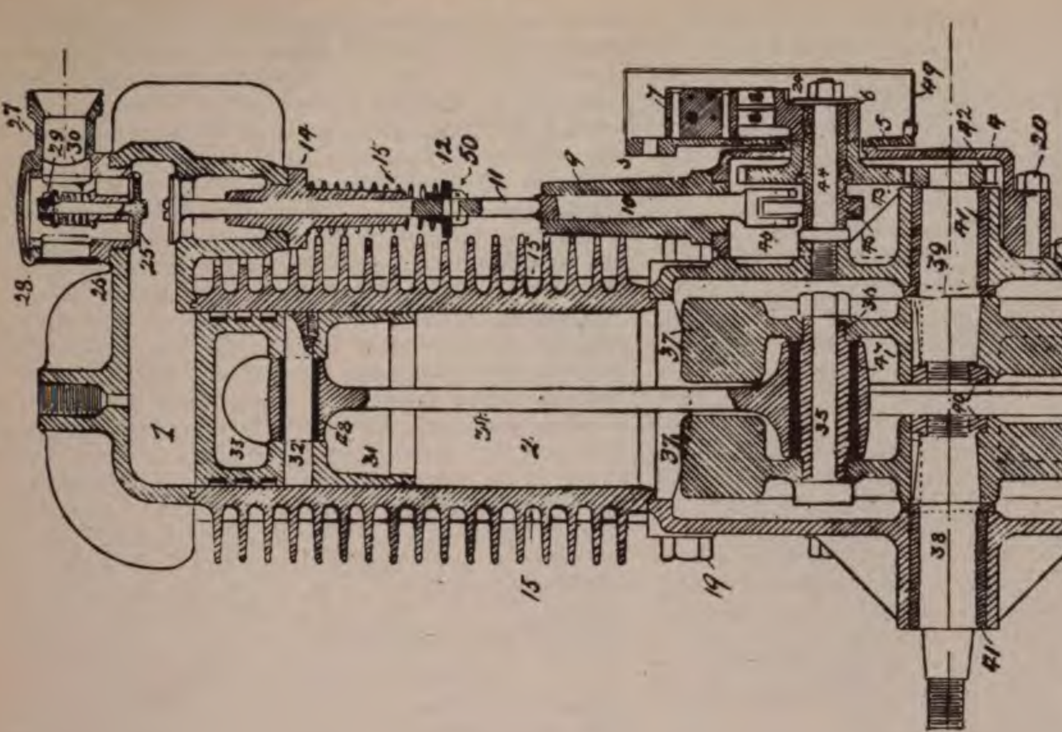


Fig. 32

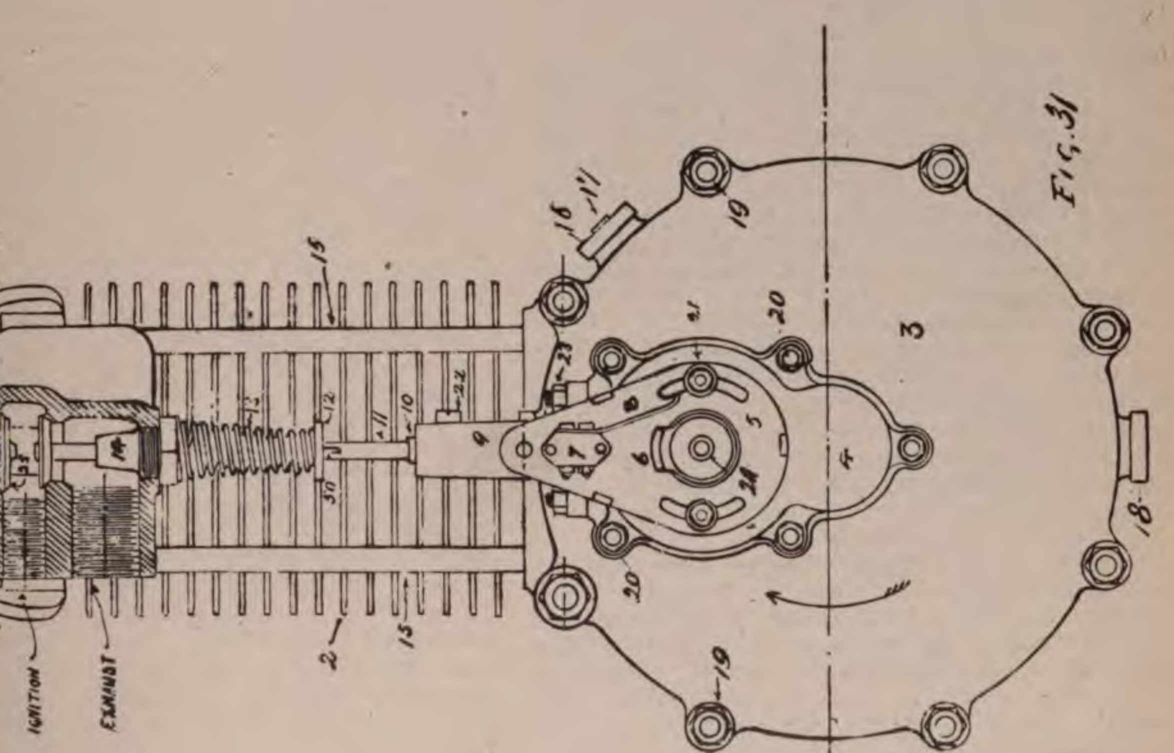


Fig. 31

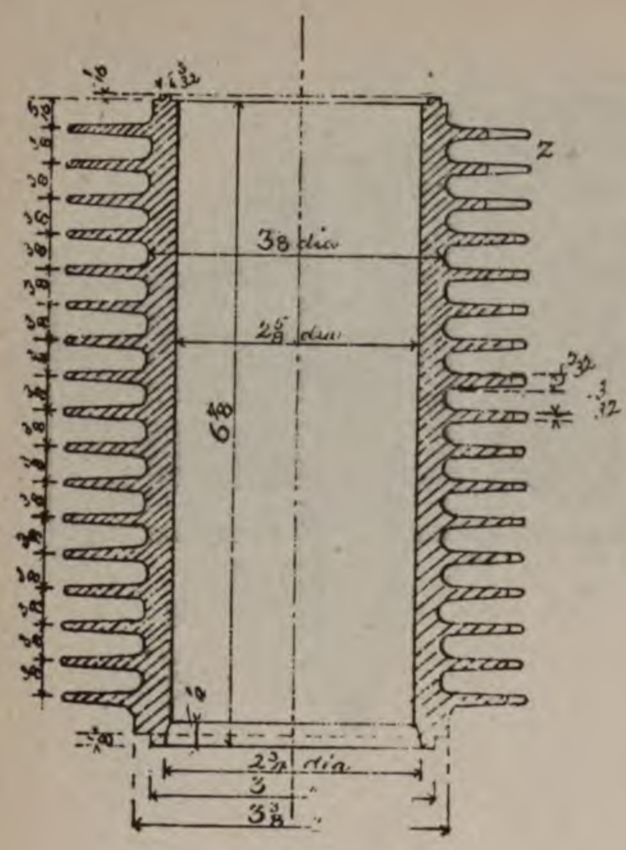


FIG. 5

diagonally with a 45-deg. gap. By means of a band or other suitable chucking device the ring is drawn together and placed in lathe for a light chip from the outside. If clips bear on the edges by means of, say, three bolts, the outer band can be removed, and the ring is then turned to size and eccentrically, viz., a 1-16 in. at the joint and 3-32 in. at a point opposite to the joint. A 1-16-in. pin should be in each groove of piston and a small notch in the ring joint. By placing the pins at 120 deg. apart the ring joint will be prevented from getting in the same straight line.

THE CONNECTING ROD.

Two views are given in Fig. 7. It is made from a mild steel forging from the solid, without welding. The holes are bushed with hardened steel bushings. Before hardening oil grooves should be cut a bare 1-32 in. deep in both bushes. The holes in rod can be made for a shrink fit or the bushes can be held from rotating by a small screw; the former plan is much the more preferable.

CRANK PIN AND BOLT.

The crank pin sleeve, Fig. 9, is hardened steel, and should be ground to a good fit. The bolt, Fig. 10, is of mild steel turned all over. The semi-circular notch in the head is to receive a pin screwed into the crank disk to prevent the bolt from turning round when screwing up the nut. The nut must be a good fit on bolt, and when in place a 5-16-in. screw should be put into nut and bolt similar to the one shown in piston pin.

THE CRANK CHAMBER.

Fig. 11 is an elevation of the side of crank case, having valve and ignition gears; Fig 12 is a vertical section through crank shaft bearing, and Fig. 13 a plan, showing facing for cylinder end, etc. For lightness this can be cast of aluminoid or some equally light metal. In making patterns for aluminum castings, more allowance for finish should be made than with other metals, the edging coming somewhat spongy; probably ⅛ in. will be sufficient. Observe the way one-half of crank case is fitted into the other, vide Fig. 12; this acts as a dowel. Note also that one bolt is larger than the rest; this is to hold crank case to vehicle frame. All these bolts in crank case should be turned to fit the holes. Care must be taken to get the cylinder exactly square with crank shaft. The two hubs, on upper side and bottom of case, are for admission and discharge of the lubricating oil. The upper one, besides acting as a plug, has a small valve, about ⅛ in. diameter, fitted to it. This valve opens outwardly and serves to relieve the case of any pressure that may leak past the piston into the chamber. The crank shaft bushings are of good hard gun metal turned all over to the dimensions given in Fig 12. The bearings are prevented from rotating by small blind screws put through the hubs on crank case and entering slightly into bushes. The bearings must be a close fit and driven lightly into place with the aid of a piece of hard wood or a rawhide hammer. If the bearings are at all loose, the action of the motor will soon find it and render them useless.

THE VALVE-GEARING COVER.

This, Fig. 14, like the crank chamber, is cast in aluminum or an alloy of same. The studs for same when tightly screwed into crank chamber are lightly riveted over on the back. The guide for exhaust valve rod, Fig. 15, is of cast gun metal and is finished all over. The two holes on side of guide are for ¼-in. set screws. These screws are turned down at end to 3-16 in. diameter for a distance of ⅛ in., and fit tight in the tapped holes in guide. These are to prevent the exhaust valve rod from turning in the guide. The exhaust valve rod, which carries the cam roller, is shown in Fig. 16. It is of mild steel, finished all over. The cup-shaped recess in end is to receive the end of exhaust valve steam, and is ¼ in. diameter by ⅜ in.

FIG 6

deep. The fork on end of rod must pass through the ¾-in. hole on top of valve gear cover, the corners being filed off where necessary.

CRANK DISKS.

These, Fig. 17, are of cast iron. A recess is to be turned out for the crank shaft nut (Fig. 19, B). The two halves of crank shaft are made from mild steel to the sizes given in Fig. 18. The two nuts (Fig. 19, B) are also mild steel. After finishing shafts to the holes in crank disks they can be put in place, the nuts tightened and the crank disks turned up on face and sides, using the shafts as arbors for that purpose. Note that keyways are cut parallel to axis of shaft and not to taper of same. This permits the disks being drawn up to a firm bearing without interference with fit of key. Obviously the holes bored in disks must be exactly the same distance apart and all work on the shafts and disks of the best grade.

THE VALVE GEAR.

Fig. 19, A shows the valve gear pinion in section and elevation. It is turned from a piece of mild steel and must be 1⅜ in. outside diameter and is to have cut teeth. The pitch of teeth, both on this pinion and on the wheel, Fig. 20, is No. 16 diametral pitch; the pinion, being 1¼-in. pitch diameter, will therefore have 20 teeth. The hole in center is to fit on end of the crank shaft, Fig 18, B. When so fitted a 3-16-in. screw is put half into the pinion and the other half into shaft, to act as a key and retain the pinion in place endways. The wheel, Fig. 20, is of cast gun metal, finished all over; outside diameter, 2⅝ in., with 40 teeth. The center hole and recess are bored to fit the exhaust cam sleeve, Fig. 21, B. This cam sleeve is made of tool steel, hardened and tempered to a dark straw color. The exhaust cam on sleeve is filed up to shape from a collar 1⅛ in. diameter by 5-16 in. wide, turned solid with sleeve. The stud for cam sleeve to work on (Fig. 21, A) is of mild steel, case hardened on bearing. When screwed up tight a ⅛-in. hole is to be drilled between hub and stud and a slightly tapered pin driven in tight to prevent stud getting loose.

IGNITION TIMING GEAR.

In Fig. 22 is a section and elevation of this gear complete. The pear-shaped back plate is of cast gun metal and is arranged to turn slightly in the bored hole in the front of valve gear cover (Fig. 14). The movement is limited by two studs screwed into the valve gear cover and working through the slots in ignition gear arm (Fig. 22). The block A, Fig. 22, carrying the contact spring B, is of vulcanized fiber, and must be riveted firmly to plate by ⅛-in. brass pins. To this block the contact springs B are secured by one ⅛-in. bolt (brass) and one 1-16-in. pin, each. These bolts are fitted with nuts and lock nuts, between which the wires of the primary circuit are secured. The contact springs B are of steel, 1-32 in. thick, and must be insulated from each other and from the arm carrying the fiber block. The holes for screws in the lugs for holding on cover are drilled and tapped ⅛ in. after cover is made and fitted. In Fig. 22 the contact springs are shown on the wrong side of insulating block.

THE EXHAUST VALVE.

Fig. 23, A, is made of mild steel in one piece. After forging, center and turn down nearly to size; then carefully anneal and cool it very slowly, buried in ashes. The object is to prevent the warping of the valve during use. It gets very hot in use, and any spring left in would then develop, causing it to leak badly. When quite cool after annealing, turn to exact size and grind in valve to the bearing in cylinder head valve box. Grind with oil stone dust or pumice powder and oil. Avoid the use of emery for this purpose. The saw cut in the projection on head of valve is to receive a screwdriver for use in grinding. The slot cut in stem is to receive the cotter, Fig. 23, B. This serves to hold the spring collar (Fig. 23, C) in place and is made a nice fit in slot. The spring collar (Fig. 23, C) is of mild steel, finished all over. The spring (Fig. 23, D) is piano wire wound on a taper arbor and ends arranged to bear evenly on collar and shoulder of exhaust valve guide (Fig. 4). It is hardened in oil. The size of wire will be No. 15 B & S. Its strength need only be enough to prevent the suction of piston from raising it.

The ignition timing cam (Fig. 24, A) is made of steel, hardened and tempered to a brown. In turning, the overhanging cam portion is made as a complete circle, the unnecessary part being subsequently filed away. A keyway to suit the key on the exhaust cam sleeve is to be cut, but its position cannot be defined until the final adjustments of the motor are being made. For this reason the hardening must be delayed until the keyway can be marked off and cut. The roller for the exhaust valve rod (Fig. 16) is shown in Fig. 24, B, and should be of tempered tool steel. It runs on a ¼-in. steel pin put through the fork on exhaust valve rod. The cover to protect the ignition gear from wind and grit is seen in Fig. 25. This is best made by hard soldering from No. 19 B. & S. sheet brass. This cover is held in place by three ⅛-in. screws tapped into the lugs on the ignition arm (Fig. 22).

THE INDUCTION VALVE.

The seat for admission valve is best made of malleable iron, but cast iron will serve, and is more easily obtained. Fig. 26 shows the seat in elevation, vertical section and plan. Three or four 3-32-in. holes, about ⅛ in. deep, are drilled in the edge of collar on valve seat for a wrench to enter when screwing down into place. Fig. 27 shows the cover for the admission valve. This is made of gun metal. Fig. 28, the admission valve, is of mild steel, finished all over. Note the slot for grinding. The seat of this valve is made flat, as being less liable to stick to its seat, than if made conical, like the exhaust valve. The collar for retaining the spring in place is shown in the same figure. This is made of steel, threaded to fit valve stem. It is prevented from working loose by a pin between collar and stem. The spring must be light and quick in action. Wire of about No. 24 B. & S. will be suitable. The pressure needed to raise the valve from seat when spring is in position should be about 4 oz. The casing surrounding the induction valve seat (Fig. 29) is of cast gun metal and carries the union for vapor pipe. The inside is bored out 1½ in. diameter to fit the corresponding shoulders on induction valve seat and cover. This construction makes it possible to adjust the position of valve inlet, however much the seat may be forced into the cylinder head, a slight loosening of the gun metal cover allowing the casing and coupling to be turned around to any angle. The coupling nut and cone for vapor pipe (Fig. 30) are both of gun metal. The cone is ground into coupling with pumice powder and water. The nut should be a good fit on thread. In Fig. 31 is given a side elevation of the motor complete, with valve box in section, showing the ignition and exhaust hubs. The cover of the ignition gear is removed in this view. The references to the figures in this view are as follows:

No. 1, cylinder head and valve box; 2, cylinder; 3, crank chamber (valve gear side); 4 valve gear cover; 5, ignition arm; 6, ignition cam; 7, insulating block for contact springs; 8 contact springs; 9, exhaust valve rod guide; 10, exhaust valve rod; 11, exhaust valve stem; 12, collar for exhaust valve spring;

13, exhaust valve spring; 14, exhaust valve guide; 15, cylinder studs and nuts; 16, plug for lubricating oil inlet to the crank chamber; 17, valve in plug; 18, plug for waste lubricating oil outlet; 19, crank chamber bolts and nuts; 20, studs and nuts for valve gear cover; 21, studs, nuts and washers for ignition arm; 22, set screws for preventing rotation of exhaust valve rod; 23, studs for exhaust valve guide; 24, nut and washer for valve gear stud; 25, admission valve; 26, admission valve seat; 27, admission valve casing; 28, admission valve cover.

Fig. 32 is a vertical section of motor, and the references to numbers are same as in Fig. 31, and are continued as follows:

No. 29, collar for admission valve spring; 30, admission valve spring; 31, piston; 32, piston pin; 33, piston rings; 34, connecting rod; 35, crank pin bolt; 36, crank pin; 37, crank disks; 38, crank shaft, driving end; 39, crank shaft, valve gear end; 40, crank shaft nuts; 41, crank shaft bearings; 42, valve gear pinion; 43, valve gear wheel; 44, valve gear stud; 45, exhaust cam sleeve; 46, exhaust valve rod roller; 47, bushing for connecting rod, large end; 48, bushing for connecting rod, small end; 49, ignition gear cover; 50, cotter for exhaust valve spring collar.

The valve chamber must be ground on to the face of cylinder end with pumice and oil until the joint faces touch all over; then wipe off all traces of the grinding medium and lay a piece of asbestos string in the groove; the asbestos should be about 1-16 in. in diameter, and when bolted down the joint will close up nicely.

The cylinder studs are each 8¼ in. long and ⅜ in. diameter, one end threaded one-half up and at the other end ¾ in. for the nut. The stud for valve gear cover is 1 7-16 in. long and ¼ in. diameter, one end thread up ⅜ in., the other to a distance of 7-16 in.

VALVE SETTING.

Take a piece of straight brass or iron wire small enough to pass through the 3-32-in. hole drilled in the top of the cylinder head for the compression relief valve. Means must also be provided for rotating the crank shaft. Pass the wire through the top of the cylinder head, so that it rests upon the top of the piston, and turn the crank shaft until the piston, as shown by the movement of the wire, is at its lowest point. Make a mark on the wire when in this position, level with the top of hub on cylinder head. Now turn the crank shaft until the piston reaches the top of the stroke and again mark the wire. Take out the wire and make a mark at ¼ in. below the top scratch. This will indicate when the piston is within ¼ in. of its lowest position, which is the point in the stroke at which the exhaust valve commences to open. Take the valve gear cover (Fig. 14) and place it in position on its studs, but do not put the nuts on as yet. Now, put the exhaust valve rod and guide in position, but without the spring, for convenience in raising the rod, etc. Turn the crank shaft slowly and note the point at which the exhaust valve commences to rise. This should occur when the piston has still ¼ in. to move outward.

If not correct, take off the exhaust valve rod guide and pull the valve gear cover and the cam sleeve forward until the gear wheels are clear of each other. Then turn the cam sleeve, and with it the gear wheel, back and forward, trying the action of the cam on its roller, until the exhaust valve is found to open at the right time.

The cam is so designed as to allow the valve to close on the piston attaining its topmost position. When the correct relative position of the gear wheel and pinion have been ascertained, mark them so that if at any time they should be taken apart they can always be put into gear correctly. This accomplished, the valve gear cover, exhaust valve rod and guide, and the exhaust valve spring may be finally put into place and nuts screwed down. Take particular care when rotating the crank shaft to turn in the right direction, as shown in Fig. 31. With the valve gear side of motor toward one, the crank shaft should revolve in the same direction the hands of a watch.

We now come to setting the ignition cam (Fig. 24, A) in its proper position relative to the exhaust cam. Rotate the crank shaft until the exhaust valve just begins to open; then turn it backward until the piston reaches the top of its stroke, using the wire through the cylinder head to know when this position is reached. With the piston in this position, and the ignition arm, Fig. 22 (see also Fig. 31, 5), vertical, the ignition cam (Fig. 24, A) should just make contact with the two contact springs on the ignition arm. Cut the keyway in the arm so that it will permit of this, slide the cam home on the cam sleeve, place the washer on end of valve gear stud, and screw up the nut to retain the cam sleeve in position. The studs, nuts and washers, which retain the ignition arm in position on the valve gear cover being screwed in, this part may be considered complete. It only remains to secure with three ⅛-in. screws the sheet brass cover over the ignition gear.

The admission valve now demands attention. Grind in valve until perfect contact is secured and wash of all oil and grit with gasoline. Replace valve on seat and put spring and collar in place. Secure the collar by a split pin; screw the valve seat firmly down, and, having slipped the case (Fig. 29) over it, screw the cover (Fig. 27) down on top. By slacking this cover the coupling on the casing can be turned in any required direction. Use an ordinary brass gas cock, ⅛-in. bore, for the compression relief valve. Choose one which is well made, with carefully fitted plug. One end should have the regular pipe thread to fit the hub on cylinder head.

There is some doubt whether in the form given there is not a likelihood of the long studs, holding down the cylinder head, having too close a resemblance to an arrangement considered by the De Dion-Bouton firm as their exclusive property. While it is questionable whether this point could be sustained, yet it is well to point out that this construction can be easily changed by casting suitable projections on top and bottom of cylinder ends and replacing the long studs by twice their number of short ones. In this case there will be no necessity to cut away the flanges, except at the lower end, just to allow the nuts on studs to clear.

CARBURETERS.

In the jet form a spray of oil is caused by the suction of the piston, and is drawn into the cylinder in a finely divided state, intimately mixed with the proper amount of air necessary for combustion. In the "surface" form of carbureter, the air is drawn through, or over, the surface of the petrol, becoming thereby charged with inflammable vapor, which is diluted with pure air to form a mixture of sufficient richness for proper combustion. Between the carbureter and the admission valve is interposed a regulating valve of simple form, by means of which the quality and quantity of the charge can be varied. This valve is controlled by two levers, suitably arranged with regard to the convenience of the rider.

A surface carbureter can be made by following these general instructions: The air enters at one side near the top, where it comes in contact with a baffle plate, or cylinder, which deflects it to the surface of the spirit. Here it comes in contact

FIG 28

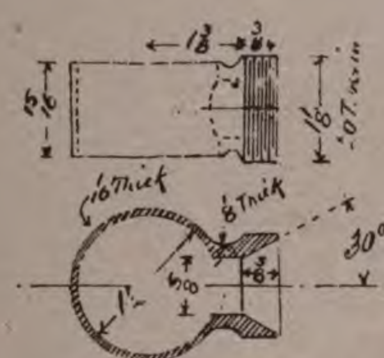


FIG. 29

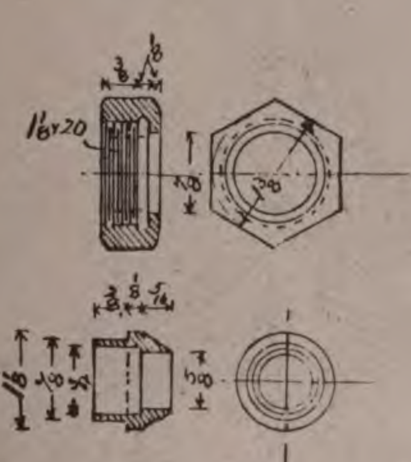


FIG. 30

with a diaphragm of coarse wick, depending from the cover and surrounding the mouth of the vapor outlet. The spirit rises by capillary attraction in the wick, and is carried off as vapor by the air (which rises between the baffle cylinder and the wick), being drawn through it.

The mingled air and vapor, which may now be termed gas, passes through fine brass wire gauze diaphragms to the regulating valve. These gauze diaphragms are to prevent arc flame from traveling back along the supply pipe and causing an explosion in the interior of the carbureter. As is well known, flame will not pass through gauze if this is of sufficient fineness, as is exemplified in the miner's lamp, of the safety type. As a further protection, a part of the regulating cock is arranged to act as a safety valve, opening against the pressure of a light spring, and thus affords relief before any pressure could reach the carbureter contents.

As the level of the liquid in the carbureter falls by evaporation, a brass float in a separate chamber falls, opening a valve admitting spirit from the main supply tank, situated at a higher level than the carbureter.

By the evaporation of the spirit the temperature of the carbureter is lowered to such an extent that vaporization becomes difficult. Some means must be provided by which this rapid cooling can be prevented.

A simple and effective remedy is to cause some portion of the exhaust from the cylinder to pass through a pipe coil in the carbureter, as shown in the description of the De Dion-Bouton motor in this issue of The Horseless Age. The coil also assists in the production of vapor as well as maintaining the temperature in accordance with the demands made on the motor.

Another point, overlooked by many motor manufacturers, is to free the air entering the carbureter from moisture as far as possible. This can be accomplished by a further use of the exhaust. A casing surrounds a portion of the exhaust pipe, and the air, before being passed into the carbureter, is drawn between the casing and the hot exhaust pipe and is thus dried. The noise caused by the suction of motor is thus somewhat reduced, and, furthermore, by cooling the exhaust, tends to render this less noisy also, the exhaust products being contracted in volume by cooling.

The necessity for freeing the air from moisture is evident when it is considered that the more watery vapor is held in suspension the less can be taken up from the spirit. Indeed, in very wet weather it has been found very difficult to start an explosive motor until the carbureter had been heated by applying cloths dipped in boiling water to the outside.

Both the carbureter, ignition plug and battery are best obtained from manufacturers, and dimensions are not given for that reason.

In conclusion, too much stress cannot be given upon the vital necessity for good workmanship in every detail. Nothing, to my mind, has so contributed to the high repute of one of the leading French motors than a close observance of this requirement, and nothing has, in all probability, been a more prolific cause of the trouble often experienced with the explosive motor than a disregard of this very point. The many little and unobtrusive matters that may affect the working of the machine, the comparatively limited information to be had of a practical, helpful kind, all conspire to render the explosive engine deserving of the epithet thrown at it by M. Georgia Knap, who terms it a capricious thing. It is with the hope of adding to the general store of reliable information that in this and my other article on explosive motor data I have paid more attention to the collection of useful material than the formulation of rules.

The Eureka Gasoline Carriage.

Ough & Waltenbaugh, engineers for the Eureka Automobile & Transportation Co., Parrott Building, San Francisco, Cal., contribute photos and description of a double-seated gasoline carriage which they have constructed for the company. They have been making tests for consumption of oil, power required in practice for different speeds on level roads, also power required to climb grades at different speeds, and are tabulating same and expect at a very early date to have some practical data on these subjects, which they have kindly promised to furnish for the benefit of our readers.

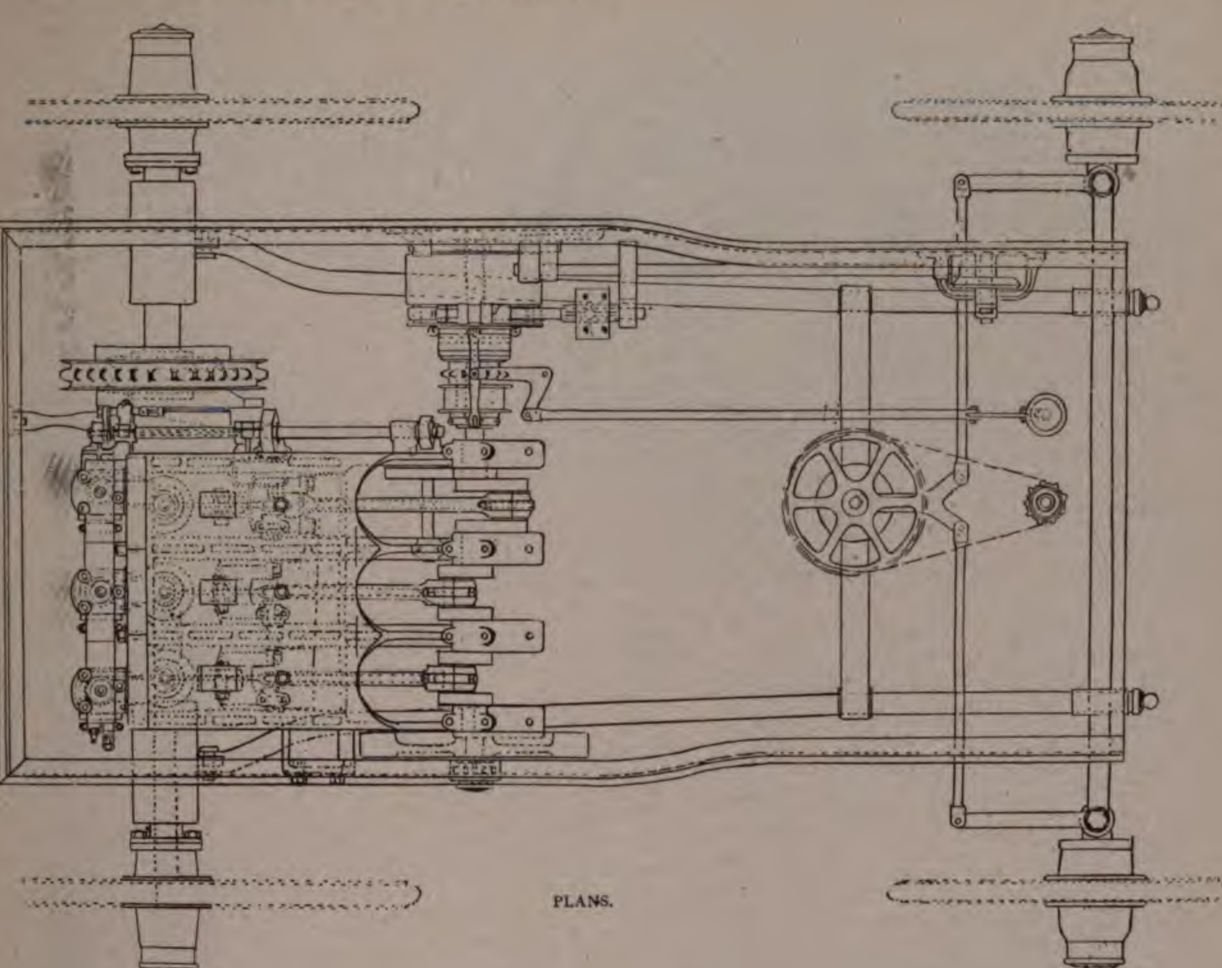
The carriage was originally built to the order of Charles L. Fair. It has some very novel features, among which is the handling or reducing gear. By the use of one lever four speeds ahead from start to maximum may be obtained by simply pushing the lever to either one of the four positions. This lever is shown on the left side of the seat. As the throwing of the lever sets the friction clutches there is no danger of breaking anything, for the friction will slip enough to start without shock. The reverse is operated by pushing forward the foot lever shown. All this gear is mounted on the engine shaft. No countershaft is used, and but a single chain from the engine to the rear wheels through the usual differential. The engine, it is understood, runs at a constant speed. The point of ignition can be changed from the front seat while the carriage is in motion by simply turning a small hand wheel either forward or backward.

The most advantageous position for igniter can be instantly determined by the power of the engine increasing or diminishing.

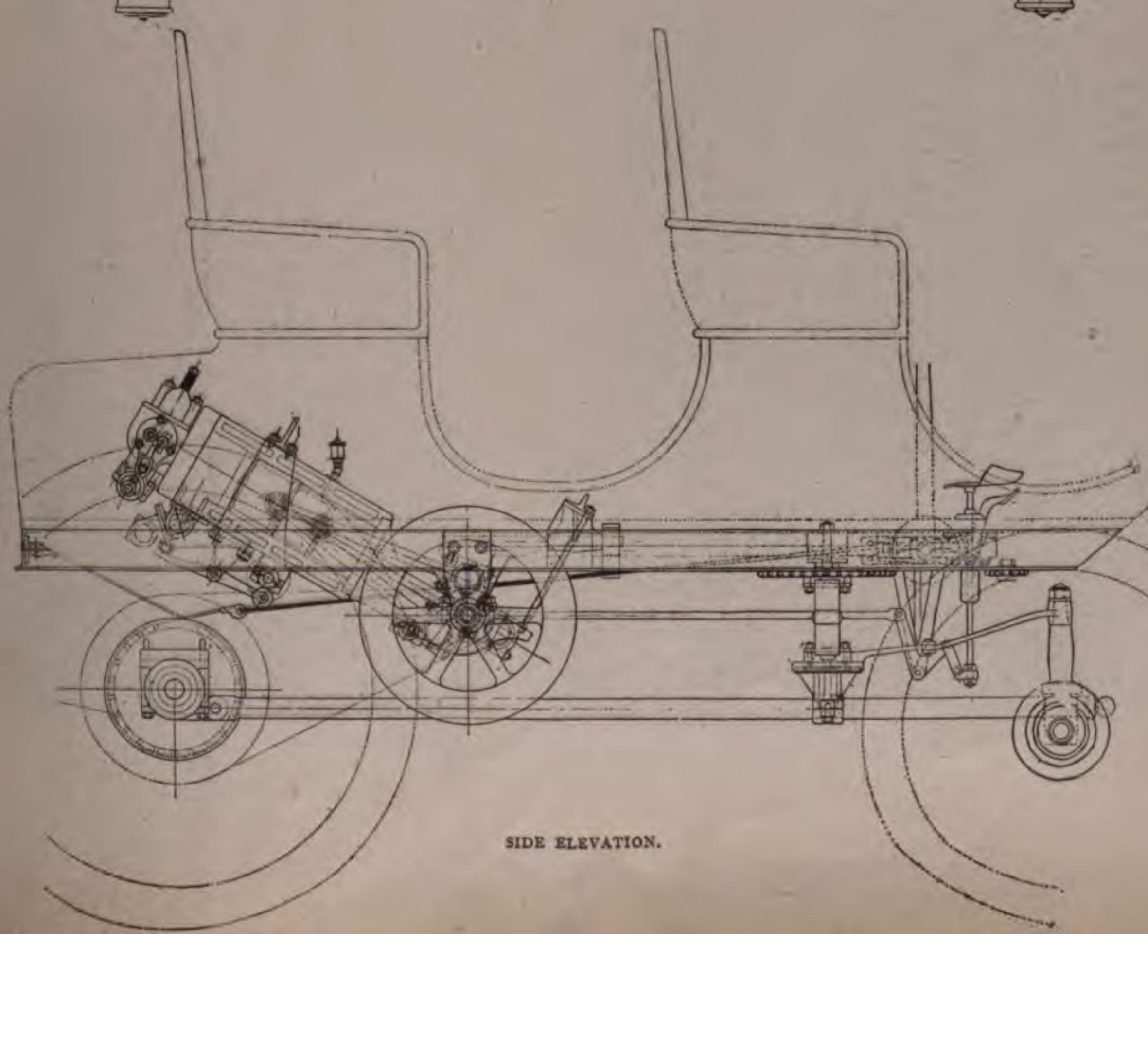
The electricity is generated by a small dynamo belted direct to the fly wheel of the engine, the current coming from a five-cell storage battery of special design, which occupies a space of 15 x 7 x 2½ in. The dynamo is used to charge this battery direct from the engine, or both together, this being controlled by switches under the flap of the front seat. The engine has three cylinders, 4¾ x 5 in.; each cylinder is wired separately, and by a specially designed switch, located in front seat, will operate each cylinder separately or all together, or any combination of the same, so that should a cylinder become short-circuited it will have no effect on the other two, and by throwing off the switch on shorted cylinder no waste of current will ensue.

The carriage is geared to 35 miles an hous when the engine is running at 650 revolutions per minute. The lowest speed power gear is 5 miles an hour with two intermediate speeds. The fastest tested speed so far is 30 miles an hour, but this speed is admittedly too fast for ordinary roads in California. The steepest grade climbed so far is one of 15½ per cent. and 2,060 ft. in length. The weight of the carriage loaded with water and gasoline is 2,640 lbs. This includes 25 gallons of gasoline and 30 gallons of water. At the time of

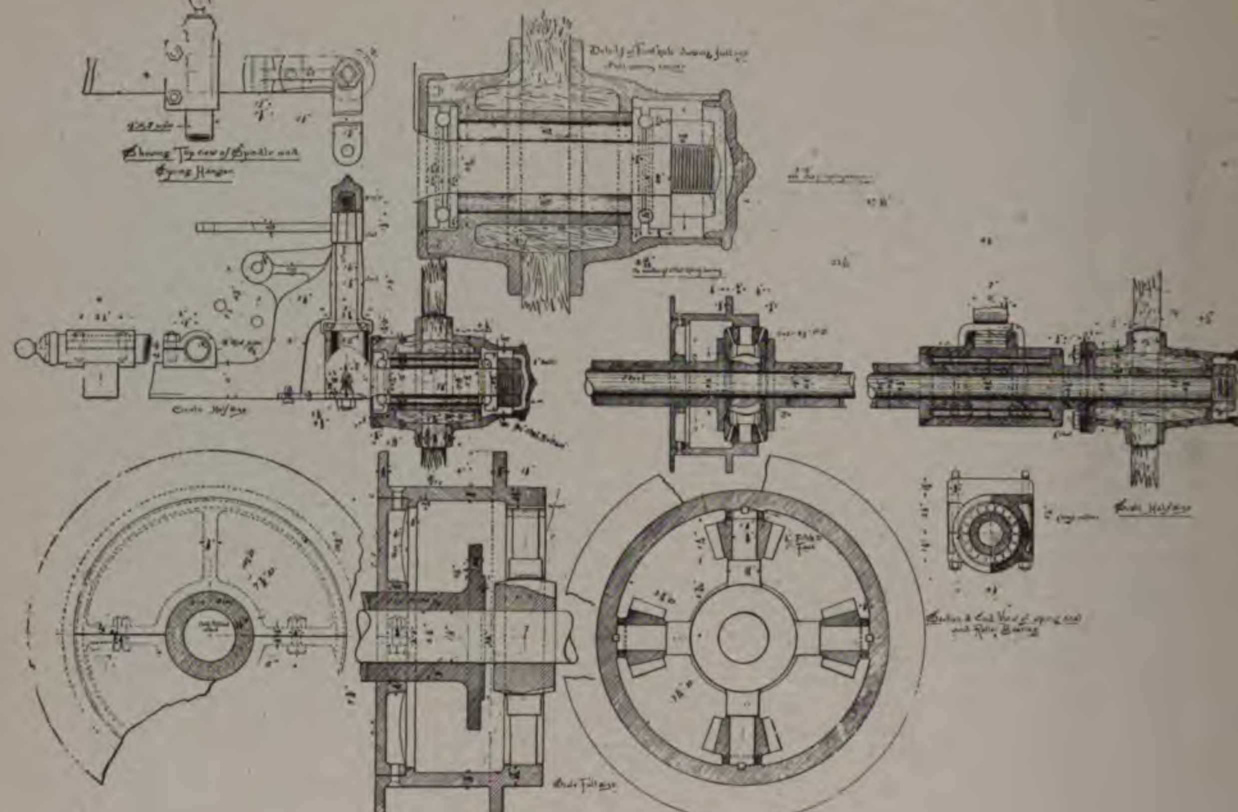
THE EUREKA GASOLINE CARRIAGE.



PLANS.



SIDE ELEVATION.



DETAIL OF FRONT AND REAR WHEELS.

FRONT VIEW.

REAR VIEW.

the test the carriage had five people in it, whose weight averaged 190 lbs. each, and the lowest speed gear was in operation and the engine valve was about half open, so that about two-thirds of its power was being used. The engine tanks and machinery are mounted on a frame that rests on the springs, and when running, the engine gives very little vibration to the carriage, the cranks being set at 120 deg. Two brakes are used—the usual band brake on a drum, connected to the differential on the rear axle, and one emergency brake thrown by an outside lever shown on the outer left side of the carriage, and applying the shoes direct to the rims of the rear wheels.

The steering handle is connected through an elliptical spring to the running gear, and the steering forks are arranged so that the center lines through both front hubs will intersect on a line projected through and from the center of the rear axle for any angle that the front wheels may be swung to the limit of swing, which is about 30 deg. The wheel base is 5 ft. 6 in., and the rear wheels are 36 in. in diameter, and the front wheels 30 in. The front axle is 1¼ in., and the rear axle 1½ in., of tool steel, runs clear through the bronze covering and besides stiffening the same keeps the differential from spreading apart, and produces an unbroken axle. The bronze covering being ½ in. thick on a side makes the rear axle 2½ in. thick at the bearings.

The bearings on the rear axle are rollers 7½ in. long; the front wheels have rollers 5 in. long, with ball thrusts. The swing joints on the front axle are ball bearings, as also the turntable of the steering springs. The consumption of gasoline is three-quarters of a gallon per hour.

This carriage has become the property of the Eureka Automobile & Transportation Co., which has acquired all the patents of the inventors and builders, Ough & Waltenbaugh, and other patents, and are now negotiating for the purchase of a very large factory, and it is expected to have several styles of carriages, delivery wagons and trucks on the market within the next twelve months.

An Automatic Starter.

The Automobile Co. of America, 32 Broadway, N. Y., whose extensive new factory at Marion, N. J., on the outskirts of Jersey City, is illustrated in their advertisement in this issue, are fitting up with the latest improved machinery to turn out all kinds of gasoline vehicles for both business and pleasure. They are now using three-cylinder motors on their carriages, developing 10-h.p., and are making other improvements, among which may be mentioned a condenser, which obviates the necessity of a water tank. They are preparing to develop the commercial vehicle with great energy, having now in hand plans for delivery and express wagons, trucks and omnibuses of standard types. A feature of their standard express wagon will be changeable bodies, so that the same running gear may be available for express or omnibus use.

An automatic starter, of which more will be said later, is a very important improvement in their new motors.

Winton Prospectus for 1900.

The Winton Motor Carriage Co. have opened an Eastern department at 120 Broadway, New York, Equitable Building, where one of their carriages will be kept on exhibition. Another carriage will also be shown at 57 West Sixty-sixth St., New York, where arrangements have been made for the storage and repair of Winton carriages, a competent man having been engaged for that purpose.

At the factory, Cleveland, O., preparations are being made to double the force of workmen and turn out not less than one complete carriage a day. They report a call for a faster machine and are consquently equipping their 1900 Special with 9-h.p. motors and 4-in. driving tires. The body will be modeled after the racing machines of France, a tool box taking the place of the dash in front.

In response to a demand for more seating capacity they are manufacturing a two-seated extension top family carriage, geared for a maximum speed of 15 miles an hour.

They are paying special attention to the finish of their machines, but in point of general effect they will adhere to the red running gear and dark Brewster green body which are distinguishing characteristics of their output.

The Autocar Co.'s New Product.

The Autocar Co., Pittsburg, Pa., is putting out a new vehicle of the Stanhope or runabout type, having seating capacity for two passengers. The gasoline motor has two cylinders with cranks set at 180 deg., and is balanced to a nicety. The speed of the motor is regulated by the electric ignition. Transmission to the rear axle from the motor is by a new and ingenious device, which consists of a drum placed on the motor shaft, through which, by the application of a brake clutch, any desired speed from 2 to 20 miles an hour can be obtained. The power is transmitted from the drum to a small countershaft, which runs on ball bearings and has a sprocket mounted thereon, and from this point to the rear axle. A compensating gear is placed in the middle of the rear axle, as also a band brake connected to the compensating gear. The compensating gear and all working parts are inclosed and run in a bath of oil, and the brake is so arranged that if the chain should let go the brake would act direct on the rear axle.

A very novel feature of the motor is that the vehicle is at all times under perfect control and will run at any speed either on a level or down grade. In coming down a grade the vehicle is allowed to descend by means of the motor and without the application of any band brake at a speed of from 3 to 5 miles an hour or faster if desired. The speed control is operated by a small lever at the side of the seat. By a simple forward motion the vehicle is started; but continuing this forward motion speed is increased until the maximum is reached. By pulling the lever back of the starting point the vehicle is reversed. Thus it will be seen that the speed control is by one lever, so that the driver has the other hand for steering the vehicle. The brake on the rear axle, which is only used in case of an emergency, is operated by a pedal. The gasoline feed is entirely automatic.

The cost of operation has been found to be about half a cent a mile on ordinary city streets. This cost will increase, however, where steep hills are encountered or on very rough roads and will decrease on boulevards or good level city streets. The weight of the vehicle is about 600 lbs. including water and gasoline sufficient for a 50-mile run. Pneumatic tired wheels are employed.

The company hopes to be able to deliver vehicles to those who have ordered this winter by April 1.

WINTON FOUR-PASSENGER FAMILY CARRIAGE.

Daimler Mfg. Co.'s Plans.

The Daimler Mfg. Co., Steinway, L. I., will issue their catalogue next month, and expect to have carriages on the market in March. They have just completed two additions to their factory, 50 x 125 ft., for machine work, and a testing house of smaller dimension. Delivery and heavy freight wagons will be manufactured first. They have recently imported eight different styles of Daimler and Panhard-Levassor wagons. Electric ignition will be used, as well as the hot tube. By an improvement in the cooling arrangements they are able to cut down the supply of water carried for a 10-hours' run to 1½ gals. The capital stock will soon be increased to $750,000.

The Phoenix Gasoline Vehicle.

The Phœnix Motor Vehicle Co., Cleveland, O., will construct a number of gasoline delivery wagons modeled after one just completed and successfully operated by R. M. Owen, the company's inventor and engineer.

The wagon has a carrying capacity of 1,000 or 1,200 lbs. of merchandise. The motor and transmission are extremely simple and compact. The motor has two cylinders, 5 x 6 in., occupying a space of 11 x 32 in., uses the regular wipe spark and is controlled by the regular throttle valve, giving a variable speed of from 200 to 750 revolutions per minute. The transmission of power is accomplished by four gears, giving two speeds forward—6 and 16 miles per hour—and one speed back. The backing mechanism is contained in a space of 2½ in. in width and is so arranged that when not in use it revolves with the shaft, thereby causing no friction from that source. The regular steering device is used. The wagon is equipped with two powerful brakes.

The Phœnix Co. have several wagons under construction for both passenger and delivery service, which will be ready for delivery by March 15.

COMMUNICATIONS.

Objects to Our Title.

Hyde Park, Mass., Jan. 9.

Editor Horseless Age:

Regarding your coming special number devoted to gas engines, I fear you are making a serious mistake in entitling it an "explosive motor" number.

It is wrong to call a gas engine an explosive engine or an explosive motor, and apart from this fact it is bad policy for an authority such as The Horseless Age to perpetuate the misnomer.

The public are frightened enough at risks of blowing up, etc., without offering them a motor whose name is "Explosion!!!" An explosion does not occur in a gas engine; therefore it is wrong in principle to call it an explosive engine.

Yours truly,

W. C. BRAMWELL.

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

GASOLINE ENGINE CASTINGS.

One to four h. p., for stationary marine or vehicles; rough or partly finished. Also complete engines, carbureters and accessories. LOWELL MODEL CO., Box 292, Lowell, Mass.

WANTED.

Locomobile or other good steam carriage. Address with full particulars and lowest cash price,
JAMES W. HENDERSON,
Room 1206, 71 Broadway, New York.

IMPORTANT IMPROVEMENTS.

Have made important and thoroughly mechanical improvements in Gasoline Vehicles, embodying numerous patentable features, fully covered by claims allowed. Am in position to show construction fully and clearly, and court thorough investigation by responsible parties only. Need sufficient capital to construct road machine and secure foreign patents, and in return for same would give to desirable party a liberal interest. Address,
A. P., care of HORSELESS AGE.

FOR SALE.

New Stanley Stanhope Locomobile, Model 3. Leather upholstered. Folding top. All latest improvements. Just received from Locomobile Company. For description and illustration see back cover of HORSELESS AGE, issue of January 10th, 1900. Will deliver immediately. For particulars address F. L. SWEANY, M. D., No. 1700 Tioga St., Philadelphia, Pa.

FOR SALE.

HAYNES-APPERSON PHAETON. Latest model. Finest finish. In perfect order—been run about one hundred miles. Immediate delivery. Price, $930. List price, $1,220. Apply THE HAYNES-APPERSON CO., Kokomo, Indiana.

WANTED.

To exchange, black gelding with record of 2.24, Crawford pneumatic runabout, harness, robes, etc., for a Hertel or other light gasoline carriage.
S. H. M., care of HORSELESS AGE.

SOMETHING NEW.

Borbein's Patent Spring Block Bearing. Full description next issue. Send for circulars. Best thing out. All manufacturers should adopt. AUTOMOBILE SUPPLY CO., St. Louis, Mo.

Complete drawings of an automobile, showing and describing each part, with dimensions, $5. Parts and supplies. AUTOMOBILE SUPPLY Co., St. Louis, Mo.

SPARKING POINTS

For electric ignition in Gas, Gasoline and Oil Engines. We make a special Sparking Point for this service, possessing extreme hardness and durability. Send for descriptive matter and prices.

BAKER & CO.,
Manufacturers of Platinum Products in all forms and sizes,
NEW YORK OFFICE, 120 Liberty St. NEWARK, N. J.

WANTED.

Good draughtsman, who has had experience in designing small gasoline carriage motors.
Address THE RIGHT MAN,
Care of HORSELESS AGE.

FOR SALE.

GENUINE PANHARD-LEVASSOR. Bought new in Paris October, 1899. Cost to import over $3,200. 4 H. P., 2 cylinders; pneumatic tires. In first-class condition, but having no further use for same will sell for $1,800 *cash*. CHARLES T. JEFFERY, 52 Institute Place, Chicago.

THE SENSATION IN MOTORDOM

Will be an altogether **new style** of Horseless Vehicle and its **steering** arrangements. Superior in every vital point to anything on the market. One-half interest of patent for sale to the right party. Address HY. VOLLMER, 1435 College Ave., St. Louis, Mo.

GASOLINE ENGINES AND CASTINGS.

Our Generator Valves to replace Carbureters, $5.00 each. Mufflers, $2.00 each. Complete set finest finished Igniter Forgings, $2.50 each.
MIANUS MOTOR WORKS, Mianus, Conn.

MUD, DUST AND DIRT

Will soon ruin gears and other running parts. Protect them with . . . . .

ALUMINUM CASES

We make them in large quantities. Write us. All kinds of Aluminum Work. .

THE HILL, WHITNEY & WOOD CO., 115 Bacon Street, Waltham, Mass.

A PERFECT **AUTOMOBILE** EQUIPMENT.

THE

EMPIRE BALL-BEARING AXLE

AND

ROBERTS' WHEEL.

PATENTED.

A fine axle, thoroughly tested by actual use under all classes of vehicles, giving perfect satisfaction.

Especially adapted to automobiles and heavy trucks. Names of users and testimonials furnished on application.

NONE SO NEAR ANTI-FRICTION.

SUPERIOR TO ANY OTHER AXLE FOR ALL KINDS OF

MOTOR VEHICLES.

AXLE DEPARTMENT.

THE CHICAGO SCREW CO., = = CHICAGO, ILL.

Address all communications to the Company. Send for Catalogue.

FOR SALE.

6—1½ H. P. Motors complete.

300—Wood Rims for 26 in. wheels.

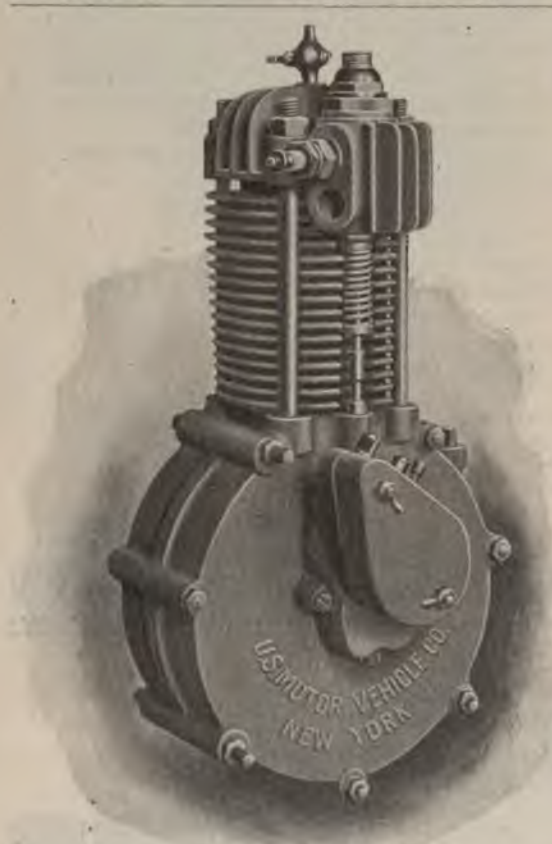
30—26 in. x 2¼ in. Pneumatic Tires, with lugs to bolt on the rim.

50—Pair of Front and Rear Hubs, made from the solid bar on a screw machine and drilled for 36 spokes. Also a number of Motor Tricycle parts.

The above for sale cheap, as we are moving into our new factory and do not care to carry the old stock with us. All goods must be sold within the next thirty days, regardless of cost.

THE AUTOCAR CO.,

THIRD AVE. AND FERRY ST., PITTSBURG, PA.


U.S. MOTOR VEHICLE CO.
NEW YORK

A PERFECT **AUTOMOBILE** EQUIPMENT.

THE

EMPIRE BALL-BEARING AXLE

AND

ROBERTS' WHEEL.

PATENTED.

A fine axle, thoroughly tested by actual use under all classes of vehicles, giving perfect satisfaction.

Especially adapted to automobiles and heavy trucks. Names of users and testimonials furnished on application.

NONE SO NEAR ANTI-FRICTION.

SUPERIOR TO ANY OTHER AXLE FOR ALL KINDS OF

MOTOR VEHICLES.

AXLE DEPARTMENT.

THE CHICAGO SCREW CO., = = CHICAGO, ILL.

Address all communications to the Company. Send for Catalogue.

Facts About Storage Batteries.

BY ISAIAH L. ROBERTS.

OTHER INFORMATION ON THIS SUBJECT BY WELL-KNOWN EXPERTS CONTAINED IN OUR

STORAGE BATTERY NUMBER. **Issue of September 27th.**

PRICE, 10 CENTS. STAMPS OR COIN.

Complete Lines of **UPRIGHT DRILLS**

From a light Friction Drill to a 42-in. B. G. P. F. Drill.

SEND FOR CATALOGUE.

W. F. and John Barnes Co.,

996 Ruby Street, - Rockford, Ill.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. V. NEW YORK, JANUARY 24, 1900. No. 17.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

Résumé.

The preliminary work which The Horseless Age mapped out for itself last fall is now accomplished. That work was twofold—reform and education. The labor of reform was the most arduous and the most imperative. The integrity of the industry was threatened. Men high in financial and political circles had fastened like vampires upon it and were draining its blood. They had organized for this purpose the most gigantic stock-jobbing scheme in the history of Wall Street. Colonel Sellers was a short-sighted visionary in comparison with them. The Lead Cab was to be made a household necessity. Companies with an aggregate capitalization of nearly $150,000,000 were incorporated on—nothing. The storage battery, on the exploitation of which the vast scheme was based, is of limited use in motor vehicles at best, and the particular type the Trust is promoting, while successful in stationary work, is admitted by all competent authorities to be unfitted for this service. On such a rotten foundation was this Babel Tower of speculation built. The rottenness has finally been exposed and the whole structure is toppling over upon the builders.

The labor of education was a much pleasanter task. In our Steam Boiler and Explosive Motor Numbers we essayed to concentrate attention upon the two motive powers which offer the greatest promise in the new field of locomotion and to present the underlying principles of each type of motor in its application to the propulsion of vehicles. We fortunately secured the co-operation of a number of engineers, who have made a study of these special branches, and were thus enabled to present a valuable compilation of practical articles in each number. In fact, at this stage of the industry, each of these numbers is a handbook of its particular branch of motor vehicle engineering, containing more up-to-date technical information than is to be found in any other single volume. If we have torn down we have also built up. For the rosy visions of the promoter we have attempted to substitute the sober judgment of common sense; for the quicksand of over-capitalization and wild exaggeration a safe foundation of science and attested fact.

The influence of the promoters of the Lead Cab speculation has been most hostile to the best interests of the industry. They have had at their command all the agencies that political influence, financial prestige and resources could afford. They subsidized the press, intrigued against opposing interests, blustered and misrepresented to bamboozle the public and unload their worthless stocks. They have been only partially successful. The plot is revealed, and they are now on the defensive. The State banking officials have had occasion to investigate some of their peculiar transactions, and the unfortunate stuckholders in their watered companies must soon join in the demand for investigation. The Trust is too rotten

to be long shielded by political influence or any other consideration, for if such questionable methods as they have resorted to are to pass without condemnation, the public must be expected to lose all confidence in its fiduciary institutions and its financial leaders.

Other promotion enterprises nearly as culpable have been or are being brazened in the public mart because of the popularity of the automobile; but they are all pigmies compared with the giant Lead Cab Trust. The liquid air swindlers reaped a rich harvest in Boston for a few weeks, but their career was cut short by the exposure of The Horseless Age. The hot water promoters in New York have procured the listing of their stock on the curb and are apparently kicking it about from one to the other to secure quotations, but since the Lead Cab Trust has got into "hot water," too, the backers of this scheme would do well to get out of it before they are burnt.

The long comedy of the promoters is concluding with a roaring farce. It is the Anglo-American Rapid Vehicle enterprise, recently brought out here by Lead Cab-Corn Pith Gibbs, Liliput Lawson, Parson Pennington and their company of special artists in prevarication, bombast and intimidation. The funniest part of it is that these late interlopers do not realize that they are playing a farce. They actually take themselves seriously and are not aware that the American investor understands them and is tired of their shallow tricks. In the light of the past career of this precious trio and recent events in the stock market here, their appearance on the scene at this time is little short of impudence. Their worn-out performance will not be tolerated.

In our efforts to purify the industry and encourage its development along sound engineering lines, we feel that we have had the support of all who have its welfare at heart. The pathway is clearer and the future surer for the plain truths that have been spoken. Some we have alienated. That we expected; but time, we believe, will convince them of the wisdom of our course. If, when their eyes are finally opened to the facts, they still stand on the side of chicanery and fraud, we shall be proud of their disapproval. From now on the stock-jobber and the manufacturer part company. Let the line remain sharply drawn.

A Simon Pure Automobile Exhibition Needed.

The opinion seems to be general among our motor vehicle manufacturers that a successful automobile exhibition could be held next May or June under the auspices of the Automobile Club of America. The undeveloped state of the industry and the want of a proper organization to act as sponsor have until the present time rendered a representative exhibition impossible. The few opportunities the public has had of becoming familiar with the automobile have been afforded by promoters of bicycle or electrical exhibitions, who recognized the popularity of the automobile as a leading attraction for the more familiar portions of their shows. Such exhibitions were no doubt productive of good and were the best that could be expected under the circumstances.

The situation has changed, however. We have in the Automobile Club of America an organization well fitted to undertake the work of an exhibition. As a neutral body, aloof from commercial entanglements and animated by a worthy ambition to further the interests of the new industry as a whole, its position is one of impartial dignity. It has and can hold the respect and confidence of the entire industry, and should it set the seal of its approval upon the enterprise the full strength of the motor movement in the United States to-day would no doubt be shown.

The only objection which we have heard to the proposition to hold an exhibition at this time is that it would conflict with the Paris Exposition. Most of the manufacturers, it is said, would be absent, and the best examples of their workmanship would be on show there. While this argument has some weight, we do not think it prohibitory. Those who contemplate visiting the Paris Exposition could easily arrange their plans to allow for the exhibition on this side of the water, too. Many vehicles which could not be completed in time to enter at Paris in April might be finished for a home exhibition in May, and in the case of the larger manufacturers duplicates of the same model could be spared for both occasions.

The important point to bear in mind is that the industry on this side of the Atlantic is languishing from too much promoting and too little performance, and that a successful exhibition would restore confidence and give a much needed stimulus to legitimate manufacture. The most promising field for our makers is the home market, and this should be first in their thoughts. All that is required to insure success is that the Automobile Club should offer its auspices and make the announcement as early as possible, in order to give as much time as possible for preparation. The necessary support will be forthcoming.

What Does It Cost?

Does it never occur to the daily newspapers and other hypnotized supporters of the Lead Cab Trust to ask themselves the question, What does it cost? The mere fact that storage battery cabs or omnibuses are put in service proves nothing further than that the promoters have sufficient funds to keep up the bluff. It makes no difference to this class of financiers whether the business is profitable or not, provided they can make the investing public think it is. What becomes of the enterprise after they have unloaded the stock is a matter of absolute indifference to them. The victims can then struggle with the deficit and lay out more money in the hope of turning the balance in favor of the stockholders. The Lead Cab

and the Lead 'Bus are preposterous. The maintenance of storage batteries in such service is positively ruinous. Perhaps the investigation into the State Trust Co.'s loans may afford us an inkling of the cost of Lead Cab promotions, if not of the operation of Lead Cabs.

Lead Cab Financiering.

We quote the following, headed "How an Office Boy Got $2,000,000," from the New York Herald of Jan. 21. It is the beginning of trouble for the Lead Cab Trust:

New light was thrown yesterday upon the deal by which the syndicate in control of the State Trust Co. was enabled to borrow $2,000,000 on the collateral note given by Daniel H. Shea, office boy for Thomas F. Ryan. The securities which were pledged to cover the loan were those which had been secured through a compromise between the Storage Battery Co. and the Electric Vehicle Co.

For several years Isaac L. Rice, who now lives at West End Ave. and Seventy-ninth St., was president of the Storage Battery Co. For many months his company had difficulty in maintaining its position, but ultimately he obtained control of most of the important patents on storage batteries.

During its financial struggle the Storage Battery Co. gave to the Electric Vehicle Co. the right to use storage batteries on vehicles all over the country, agreeing to sell batteries and machinery to that company at all times at 15 per cent. below the market price.

When the boom in Wall Street arrived those who control the affairs of the State Trust Co. formed a syndicate for the purpose of taking over the Storage Battery Co. This they did after a keen contest with Mr. Rice. But they did not get control of the majority of the stock until after its price had been jumped from $20 to $120 per share.

After their plans were fully matured Mr. Rice was forced out. He went from the Storage Battery Co. to the Electric Vehicle Co., of which he became president. This concern had been organized under the laws of New Jersey, and had been authorized to issue $5,000,000 worth of preferred stock and $5,000,000 worth of common stock. The common stock had been disposed of to its full issue and $1,000,000 worth of the preferred stock had been disposed of before Mr. Rice took active control. He found still in the company's treasury $4,000,000 worth of preferred stock, which the directors had the right to dispose of as they best saw fit.

In the meantime the Storage Battery Co. was under the control of William C. Whitney, P. A. B. Widener, Thomas F. Ryan, Anthony N. Brady and others. The controlling syndicate was disturbed when it found a record of the contract entered into between the Storage Battery Co. and the Electric Vehicle Co., giving the latter the right to call for batteries and machinery below the market price. An acrimonious dispute arose, resulting in threats of legal proceedings. An ultimatum was delivered to Mr. Rice, who promptly hurled it back.

At this juncture James R. Keene was called upon to use his power to bring about a compromise. The result was a conference, which was held the latter part of last April in the Waldorf-Astoria, at which were present beside the members of the syndicate, Elihu Root, now Secretary of War; James R. Keene and Mr. Rice. Mr. Rice maintained his position, declaring that a contract was a contract and that any compromise which was to come must be offered by his opponents.

Mr. Rice, freely admitting that the ElectricVehicle Co. needed cash, made a proposition, which was accepted. The Storage Battery Co. was to take the $4,000,000 worth of preferred stock which still remained in the treasury of the Electric Vehicle Co. at 50 per cent. of its face value, which was far below the market quotation. This preferred stock was to pass directly into the control of the Storage Battery Co. Then, for the benefit of the syndicate, $2,000,000 worth of common stock was to be issued by the Electric Vehicle Co. and taken by the syndicate at par, that also being below the market quotations.

Pursuant to this agreement, on May 13, 1899, permission was secured in New Jersey for the issuance of the additional $2,000,000 of common stock. Instead of turning $4,000,000 worth of preferred stock into the treasury of the Storage Battery Co., $2,000,000 worth of the preferred stock and $2,000,000 worth of the common stock of the Electric Vehicle Co. were turned over by the syndicate. The other $2,000,000 worth of preferred stock was taken possession of by the members of the syndicate. Three days later the State Trust Co. took as part security this same preferred stock for a loan of $2,000,000 to Daniel H. Shea, Mr. Ryan's office boy. This $2,000,000, it is said, was used to complete the transaction, paying for the total of $6,000,000 of common and preferred stock purchased from the Electric Vehicle Co.

At this time James R. Keene owned 1,500 shares of the Electric Vehicle Co.'s stock, and for bringing about the compromise he was to receive 2,500 shares. Mr. Keene, however, became dissatisfied when he learned that, unknown to him, another agreement had been entered into between Mr. Rice and the syndicate, which was that the $4,000,000 in cash which had been paid to the Electric Vehicle Co. should by that concern be placed on deposit with the State Trust Co., thus bringing the entire amount back to the source from which it came. It should be said here that the individual members of the syndicate had deposited other securities with the State Trust Co., which had advanced another $2,000,000.

Disgusted at this condition of affairs, Mr. Keene threw upon the market his 1,500 shares, causing the first break in the price of the securities. He has never seen the 2,500 shares promised to him.

The financiering methods of the Lead Cab promoters are beginning to leak out at last.

ERROR.

By an error in placing the matter, the last paragraph of the article of Elwood Haynes in the Explosive Motor Number of January 17th, was incorporated in the editorial of R. I. Clegg, entitled "The Explosive Motor." The next to the last paragraph in that editorial is not Mr. Clegg's, but Mr. Haynes'.

Commercial Use of Club Badges.

In order to prevent its badge from being used to further commercial schemes, the Automobile Club of Great Britain has forbidden the wearing of its badge in any place of business. Its design may not be painted as a decoration on any vehicle except a private carriage not connected in any way with business enterprise. It must not be displayed by a member when riding on a motor vehicle which bears any com-

mercial inscription or device. It must not be worn by a member when engaged in any business affair of an automobile nature. Violation of any one of these rules is followed by forfeiture of badge. Similar regulations will no doubt be found necessary here, as signs of the virus of commercialism are already manifested in the American club, and to preserve its influence unimpaired it is absolutely essential that those who would use the club for selfish ends should be effectually repressed.

THE WINNER GASOLINE RUNABOUT.

The Cycle and Automobile Show.

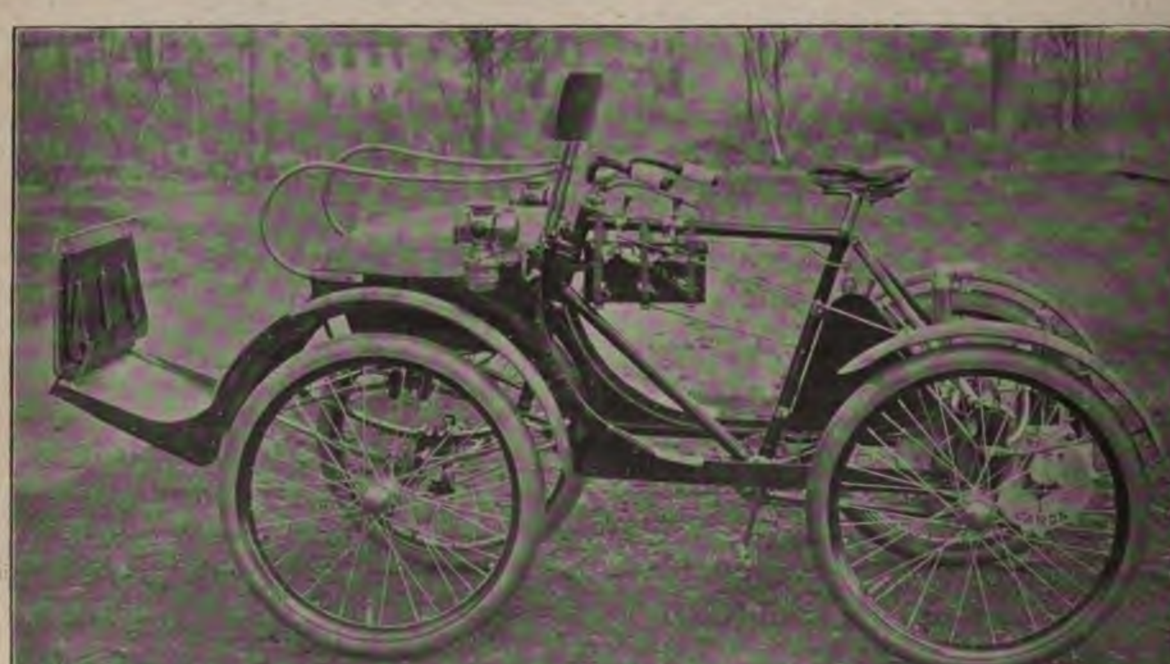
The Cycle and Automobile Show now holding at Madison Square Garden offers little that is new in the latter line.

Foster & Co., Rochester, N. Y., exhibit three vehicles—two steam carriages and an electric runabout weighing 950 lbs. and carrying a battery of 40 cells, which, it is claimed, is capable of being charged in 45 minutes. The motor weighs 104 lbs., and there are three speeds forward and two backward. Transmission is by sprocket and chain. On level city road the vehicle will make 50 to 60 miles on one charge. Strong claims are made for its noiseless action.

The steam carriages are of the runabout type, weighing 700 lbs. and having as motive power a vertical marine Shipman engine giving 6-h.p. at 600 revolutions and weighing 60 lbs., and a tubular boiler containing 300 ½-in. copper tubes and weighing 110 lbs. Transmission is by chain and sprocket. The feed of gasoline to the burner is governed by hand by means of pet cocks that can be tested while the carriage is in motion. No water gauge is employed. The supply of water to the boiler can be regulated even on a hill without leaving the seat.

The Loomis Automobile Co., Westfield, Mass., exhibit a light park carriage driven by a gasoline motor of 2½-h.p. geared to give a maximum speed of 15 miles an hour. All the machinery is hung on the hind axle. No carbureter is used and no water jacket. The weight of the machine is 315 lbs. and its price $450. This concern also has under construction a road carriage and a delivery wagon.

The Oakman Motor Vehicle Co., Greenfield, Mass., showed one of their Hertel carriages in connection with the exhibit of the Iven-Brandenburg Co., which included a new roller bearing called the "Thor," especially recommended for motor vehicles. It consists of a series of short rollers containing balls to take the end thrust.



GASOLINE QUADRICYCLE OF THE CANDA MFG. CO.

The Automobile Forecarriage Co., recently organized in New York to purchase the United States patents under the Kullstein-Vollmer gasoline forecarriage system, showed one of these forecarriages fitted to an ordinary horse carriage, which attracted much attention, because of the novelty of the idea to the American public. The company will develop the business at once as rapidly as possible.

Three well-known manufacturers of electric vehicles participated—the Riker Electric Vehicle Co., the American Electric Vehicle Co. and the Indiana Bicycle Co. The Riker Co. show eight vehicles, including a theater bus and a heavy wagon for delivering mineral water.

The General Electric Automobile Co., of Philadelphia, Pa., show one of their vehicles.

Considerable interest is manifested in the exhibit of the motor quadricycle of the Canda Mfg. Co., Carteret, N. J., modeled after the De Dion-Bouton machine, but superior in finish and 35 lbs. lighter.

The central portion of the frame which carries the saddle is of seamless tubing and follows closely standard bicycle lines. Outside of this, at the level of the axles, is another frame of angle iron and steel brackets. Braces connect the two parts and form a light, strong and stiff structure.

The machine "tracks" 36 in. in width, and is 46 in. from center to center of the axles. It is 7 ft. 6 in. long and 3 ft. 6 in. wide. The wheels are 26 in. diameter, of the tangent spoke tension type, with 2½-in. pneumatic tires. Complete, ready for service, it weighs 350 lbs.

The engine mounted over the rear axle, when running at normal speed, develops about 1¾ h.p.

The speed has a range of from 2½ to 25 miles per hour.

Another interesting exhibit is that of the Elgin Automobile Co., Elgin, Ill., and Baltimore Bldg., Chicago, Ill., who manufacture gasoline runabouts and gasoline delivery wagons. Single-cylinder Otto cycle engines of 5-h.p. are used, giving a maximum speed of 15 miles an hour. There are two levers, one for steering, the other for change of speed. The weight of the gasoline runabout is 700 lbs. It is called the Winner and has wheels of 32 in. diameter, tread of 50 in. and wheel base of 54 in. The company will also turn out an electric runabout called the Elgin.

Manufacturers of motor vehicle bearings and tires represented were: The American Roller Bearing Co., the Grant Axle and Wheel Co., the Diamond Rubber Co., and the Consolidated Rubber Tire Co.

Lead Cab Activity in Boston.

The New England Electric Vehicle & Transportation Co. has about 60 men in its employ, and this number is said to be able to handle ten times the number of vehicles at present in operation. The company is now running 20 hansoms, about the same number of broughams, and one or two mercantile delivery wagons in its public service. It has seven broughams or other types now under lease by the month to private parties, and announces that inside of another month it expects to get in the first of a lot of 25 delivery wagons, which are to be leased to mercantile establishments in the city.

A new re-charging station is about to be opened at the end of the Beacon St. boulevard, at Chestnut Hill reservoir, Brookline, Mass. This station is important, since it is at the threshold of a delightful system of drives through the Newtons and Brookline—a section which electric automobilists from Boston have hardly dared to risk on the strength of a single battery charge. The new station will also make it possible for electric delivery wagons from Boston to cover the Newton district.

Boston automobilists were watched with a good deal of interest during the heavy snow ten days ago to see how their vehicles would stand up. The Locomobile Co.'s carriages were running in Newton, though the vehicle in use by the city of Boston was not taken out because there was no call for it in a business way. The electric cab company ran its broughams, but did not send out the open front hansoms. Most of the electric delivery wagons operated by various Boston concerns were in service. The public cabs reported the biggest difficulty after the snow began to melt, for drifts near the curb made trouble in getting up to and away from the sidewalks. One or two of the cabs had difficulty in getting back to the central station in the storm on account of the heavy drain on their batteries. The order to the drivers were to accept no calls for long-distance service, and to return to the re-charging station after every three or four city calls.

The electric vehicle combination in Boston expects to receive 20 open wagonettes and similar light vehicles for its summer business about April 1.

It is said that sixteen out of the twenty-odd drivers of the public electric cabs and broughams in Boston are men who went to the vehicle company from the street car company. They like the work on the cabs better than on the rear platforms of the trolleys. They get about $14 a week, do all their work within 12 hours, and find the people they have to serve more agreeable than the ordinary street car passengers. One or two of them have secured positions in charge of the re-charging stations in the suburbs, and these positions command $25 a week.

The Milwaukee Automobile Co.'s Steam Runabout.

This newly organized concern has on tapis a stanhope runabout propelled by steam. Wire wheels 28 in. in diameter will be used, with 2½-in. pneumatics. The tread will be 50 in. and the length of the wheel base 58 in. The estimated weight is 700 lbs. The boiler, of 15½ in. outside diameter, has 350 ½-in. copper tubes, giving approximately 50 sq. ft. of heating surface, and is tested to 500 lbs. cold water pressure.

The engine is a vertical, direct-acting, double-cylinder, 2½ x 3½ stroke, giving 5-h.p. at 400 revolutions, and speed of 30 miles an hour if desired.

The company is now entering orders for spring delivery.

The Kidder Motor Vehicle Co.

The most important of recent motor vehicle incorporations is that of the Kidder Motor Vehicle Co., at Dover, Del., with a capital stock of $500,000, to manufacture steam vehicles designed and patented by Wellington P. Kidder, of Boston, Mass., known to readers of the Steam Boiler Number of The Horseless Age.

The factory will be located at New Haven, Conn. The board of directors is composed of Major T. Atwater Barnes, president (president of the New Haven Trust Co.); Hon. C. C. Colby, Stanstead, Canada, vice-president; S. Stevens, Stan-

stead, Canada; Elisha Morgan (president of the Morgan Envelope Co.), Springfield, Mass.; Charles R. Bishop (president Bishop Past & Box Co.), New Haven, Conn; Mr. Wirden, Dover, Del., and Wellington P. Kidder, Boston, Mass.

Charles R. Bishop is treasurer and general manager, George B. Barnes, secretary, and Wellington P. Kidder, consulting engineer.

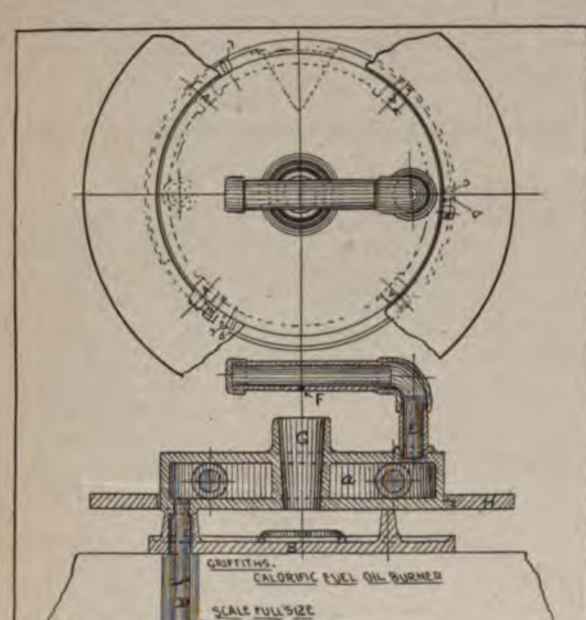
A factory has been secured and work will be begun at once on several types of heavy vehicles.

Storage of Gasoline.

At a recent meeting of the Automobile Club of America it was decided to take action for the protection of automobilists who in storing gasoline for steam or gasoline carriages might come in conflict with the New York city authorities. The club will retain lawyers to defend any automobilist arrested for violation of the law.

Griffith's Calorific Fuel Oil Burner.

To start the burner the generator A is preferably heated first by the use of rosin wood, which is placed under the generator and resting in the plate B; or the generator can be heated by letting the oil (Torch oil or Paragon oil) into the plate B. This is done by opening the needlepoint valve in the pipe D (valve not shown in the drawing). The valve should be closed again after the surface of the plate is covered. Burn a lighted



piece of paper on the oil to heat it and raise a vapor, after which the oil will burn itself. Or the generator can be heated by the use of a plumber's torch.

The oil tank leading to the pipe D carries about 5 lbs. air pressure on it ,this being sufficient to force the oil to the generator. When the generator A is heated, turn on the supply of oil at the needlepoint valve, connected with the pipe D, and regulate the amount of fire wanted by the flow of oil. This needlepoint valve can be placed in any convenient place.

The oil passes up the pipe D and into the cored out chamber of the generator A, where it is converted into a vapor, and then passes up through the pipe E and out the small opening F down through the taper funnel G, carrying with it the heated air, which always surrounds the firebox and strikes on the plate B, where it meets with sudden resistance and spreads, throwing the flame out and around the generator A.

This oil vapor and air makes an intense heat and gives perfect combustion. The flame surrounding the generator keeps it always at a high heat, at the same time acting as a spreader for the flame.

The flange H is a ring set over A and is used as an additional spreader when a large firebox is used, the idea being to throw the flame in as large a circle as possible. For small boilers such as are used in wagons a burner 6 in. in diameter is sufficient.

All grades of oil can be used in this burner excepting the common black crude oil, which would quickly clog up the valve and also the small opening F. These burners the inventor has made of iron, and also brass, one working equally as well as the other. The pipes used are extra heavy iron pipe. The whole affair is very simple and inexpensive.

When gasoline is used in this or any other burner, take the carbureted air off the oil in the tank by a pipe connected to the pipe D, and below the valve. After the air has been pumped on the gasoline, let it stand a moment, then open up the valve and allow the air to enter the pipe D and into the burners. Light same under the generator as ordinary gas, and continue as previously directed.

This burner is the invention of Daniel D. Griffiths, Chicago, Ill.

Bibliography.

"Les Moteurs a Explosion;" by M. George Moreau. This comprehensive work, some 435 pages, goes thoroughly into the general study of the explosive motor and the phenomena of its action. Some knowledge of the higher mathematics is necessary, though in the main an elementary acquaintance will suffice. Considerable of the material is to be found in other works, but the arrangement is commendable, useful and brought up to date in most convenient form.

The author gives most of his attention to theory, and his work gives few details of actual working motors, though many will find this no disadvantage.

The volume is in French and published by La Librairie Polytechnique, 15 Rue des Saints-Peres, Paris.

The Judges' Report of the Liverpool Trials of Motor Vehicles. Edited by E. S. Smith, Hon. Sec'y. 133 pages. Price, 5 shillings.

Our English correspondent has already made some selections from this volume, and we are glad to note its scope and treatment. Many illustrations, both line and half-tone, with dimensions, freely given in the text and sketches, are provided and the tests have been tabulated at considerable length. The volume is a necessity to any one interested in the progress of heavy vehicle construction, and the thorough and impartial trials, as well as the subsequent compilation of data, are most admirable.

Published by Winstanley & Watkins, 16 Cable St., Liverpool, England.

LONDON NOTES.

London, Jan. 10.

000,000,000,000!

Quite a wave of excitement has prevailed in automobile circles in London this week in connection with projected doings in America. For some weeks there has been quite unusual activity at 40 Holborn Viaduct, E. C., where are situated the offices of the British Motor Co., Ltd., and the Pennington Motor Co., Ltd., especially since the return of Mr. H. J. Lawson and Mr. E. J. Pennington from America in connection with the Anglo-American Rapid Vehicle Co. transaction. Little information has been allowed to leak out, but I hear that quite a number of Daimler motor cars and bodies for Pennington vehicles have been dispatched to America from the works of Stirling's Motor Carriages, Ltd., Hamilton, N. B., as also several motor tricycles and a 23-h.p. racing car. From what I can hear, Pennington, who left for New York on the 30th ult., proposes to hold an automobile exhibition in that city, and in addition to organize several race meetings, with the view of popularizing the automobile. In any case, Mr. C. G. Wridgway, of the Pennington Motor Co., is probably in America by this time, while Mr. C. Jarrott and other members of the staff of the British Motor Co., Ltd., will sail on the 10th inst. Messrs. Jarrott and Wridgway are two of the leading English motor tricyclists, and in England made several excellent performances on the track during the past year. As I have said, very little information has been allowed to leak out as to what all this activity means, so we shall have to sit quiet and await developments.

THE TARE WEIGHT OF HEAVY MOTOR VEHICLES.

For some time past there has been an agitation in this country in favor of an increase in the legal tare weight limit of heavy motor vehicles. Meetings in connection with the matter have been held by both the Liverpool Self-Propelled Traffic Association and the Automobile Club, as a result of which it was decided to ask the Local Government Board to receive a deputation. This week the President of the Board has replied that since the Board are not at present prepared to initiate legislation with the object proposed, it does not appear that there would be any advantage in its receiving a deputation. A report on the subject is, however, being prepared and will be submitted to the President of the Local Government Board at an early date.

AN EXTENSIVE AUTOMOBILE TOURING SCHEME.

At Stechford, near Birmingham, a company known as the British Motor Touring Co. has during the past year been very successful in running motor cars to places of interest in the district, and intends to extend the business very much this year. In fact, they have on hand the most extensive scheme in connection with automobile tours that has ever been attempted. They have placed orders for close upon 60 vehicles and are arranging branches in a number of towns and seaside resorts in the country, from which motor trips and tours ranging from an afternoon to a fortnight are to be run. The charges are to be inclusive of board and accommodation, so that it will be possible to make one payment and enjoy a week's or a fortnight's outing in an automobile.

THE WOLSELEY GASOLINE CARRIAGE.

A new two-seated carriage is about to be put on the market by the Wolseley Sheep Shearing Co., Ltd., of Alma St., Birmingham. The carriage, which is graceful in appearance, is well sprung and is fitted with cycle type wheels and pneumatic tires. The motor is of the horizontal type, with water jacket and electric ignition. The diameter of the cylinder is 4½ in. and the stroke 5 in. Three speeds forward—6, 14 and 22 miles an hour—as also a reverse motion, are provided, the transmission being effected by a belt working on cone pulleys to the countershaft, and from the latter to the rear axle by the usual sprockets and chains. The carriage measures 7 ft. 3 in. by 4 ft., and complete, with gasoline and water for a run of 100 miles, weighs 1,340 lbs.

THE AUTOMOBILE CLUB'S 1000-MILE TRIAL.

Arrangements are progressing apace in respect of the Automobile Club's 1,000-mile trial, which is to be run off in the spring. During the past two or three weeks the secretary of the club has been engaged in traveling over the projected route, and has held meetings at Bristol, Birmingham, Manchester, Edinburgh, Newcastle-on-Tyne, Leeds and Sheffield in connection with the proposals to hold one-day exhibitions in those towns. At each of the places named a local committee of automobilists has been formed to make the necessary arrangements for the exhibition of the vehicles which will take part in the trials. As a result of the meeting at Leeds it has also been resolved to form there a Yorkshire branch of the Automobile Club.

LOCOMOBILE CO. BUYS THE CLARKSON-CAPEL PATENTS.

About three months ago I intimated in this column that Clarkson & Capel, of the Clarkson-Capel Steam Car Syndicate, Ltd., London, S. E., were paying a visit to America, as a result of which, I now learn, that they have negotiated the sale of the American and Canadian patent rights in their generator, condenser, liquid fuel burner and automatic regulator to the Locomobile Co. of America. Those who met the gentlemen during their visit to the United States will regret to learn that the latter gentleman died of typhoid fever on the last day of the old year.

ANGLO-AMERICAN RAPID VEHICLE CO.

This recently organized company is now advertising American made Pennington and Daimler motor carriages in one of the automobile papers here. I should very much like to see one of these cars, for if such exist why this sending over to the United States of English built automobiles, to which I referred in my last letter. Both Harry J. Lawson and E. J. Pennington and staff will, ere this reaches you, be once more in America in connection with this company. It is rumored here that Pennington intends organizing an exhibition of the vehicles in New York; but as I said last week, little, if any, news has been allowed to leak out, and now the scene of action is on your side of the Atlantic.

The announcement is made this week that in the coming spring the Motor Car Club will hold a hill-climbing competion for motor cars. The scene of the contest will probably be the steep Westerham Hill, in Kent.

It is a disappointment to automobilists in this country to see Jan. 1 come and go without any challenge being sent to the French Automobile Club for this race from England. Formal entries have been received from Germany, America, Italy and Belgium.

On Christmas day a Daimler wagonette, carrying half a ton of mail matter, was dispatched from Lincoln on a long route to the village of New York, 8 miles from Boston, calling at 12 intermediate stations. The journey was accomplished in 3 hours and 40 minutes, or 40 minutes in advance of scheduled time. The average speed for the whole distance was 10 miles an hour, despite rough roads and frequent stops.

COMMUNICATIONS.

Criminal Proceedings Against Mr. Higdon.

St. Louis, Jan. 20.

Editor Horseless Age:

Herewith I inclose a "second edition" of the damage suit filed against me.

Some weeks ago I wrote you that these parties had filed a civil suit; but, as you now see, they have begun criminal proceedings.

I desire to deny a few of the many errors in the article published in the St. Louis Republic, Saturday, Jan. 20, 1900.

My denials are as follows:

First—I deny that my vehicle made a great noise or emitted any smoke or steam, inasmuch as the veriest novice in automobilism would know better than to use a fuel which would make smoke, or have a vehicle on the street which would make a great noise. There was absolutely no smoke or steam emitted by my vehicle, and I never went on the road with any fuel which would cause smoke.

Second—I deny that the vehicle was unusual in character or construction, movement or operation, or was calculated to frighten and terrify persons and animals. On the other hand, my vehicle is a very usual one and of ordinary construction, not calculated to terrify or frighten anything, and I have a photograph of it showing a number of small children in it and other children riding behind it on sleds. Surely, if it would not terrify small children, it ought not to frighten grown people and horses.

Third—I deny that I was negligent in the management of the vehicle. On the other hand, I have witnesses to prove that I did not approach the horses nearer than 100 ft., and I even alighted from my vehicle and ran to help control the horse, which the law does not require the driver of an automobile to do, and it was purely a gratuitous act on my part.

Furthermore, I have had the care and management of an automobile almost four years, so that it can hardly be maintained that I was an unskilled driver—in fact, the want of skill was in evidence upon the other side.

Fourth—I deny that the vehicle was running at an unusually high rate of speed.

Fifth—I deny that the accident was the sole cause of one lady's death, inasmuch as it is well known she was suffering from lung trouble and had a number of hemorrhages prior to the accident.

Sixth—The article states that I saw the horse prancing when he was 125 yds. away, when the fact is that the automobile stopped some moments before the driver of the horse tried to stop him, and he kept going toward the automobile until he got within about 100 ft. of it. Very truly yours,

JOHN C. HIGDON.

The newspaper clipping which Mr. Higdon inclosed gives an account of his indictment and arrest on a charge of feloniously injuring Mrs. Katharine Anselm and her daughter on the Olive St. road on Sept. 21 by the use of an automobile. Mr. Higdon was subsequently released on $500 bail. The daughter referred to, Mrs. Pauli, has since died, the prosecution claims, of her injuries received on that day; but the defense state that her end was due to consumption, from which she had been a sufferer.

Damage suits aggregating $7,300 are also pending against Mr. Higdon because of the accident.

THE INDICTMENT.

The indictment against Mr. Higdon charges that on Sept. 21, 1899, Mrs. Anselm and Mrs. Pauli were driving west on the Olive St. road, when they met Mr. Higdon in a vehicle which, to use the language of the bill, was propelled by steam, made a great noise and emitted large quantities of smoke and steam, was unusual in character of construction, movement and operation, and calculated to frighten and terrify persons and animals. Mr. Higdon is charged with not using care in the management of the vehicle, and running at such a high rate of speed that the horse driven by the ladies became unmanageable, turned over their buggy and threw them out. The witnesses to the accident were then named.

Since the accident Mrs. Pauli has died. In fact, she was attacked with a hemorrhage the same evening shortly after reaching her home on the North and South road, near Clayton, and died nine days later. She left three small children, and her father, Theobald Anselm, shortly afterwards, in their behalf, filed suit against Mr. Higdon for $5,000 damages, holding him responsible for their mother's death. He also asked $300 for the injury to his horse and buggy and $2,000 for his wife's injuries.

MR. HIGDON'S SIDE.

Mr. Higdon is indignant over his arrest and declares it is his belief that an attempt is being made to blackmail him. He says:

"It is not true that I collided with the buggy driven by the ladies. I was riding in the Olive St. road with my two boys when I met them. When some distance away I saw the horse was getting restless. I would say it was about 125 yds. when I saw him prancing. When I got within 100 ft. of the buggy I stopped and got out to help the ladies; but before I reached them the horse had wheeled around to the right, overturned the buggy and broke loose from the shaft, running across the field. The harness he wore seemed to be very poor. I started after him at first, but came back, as I wanted to get my boys back home before night. Both of the ladies ran up to me and grabbed me, saying that I had to pay for the damage. One of them grabbed at my watch chain. I had to push them away.

"They have charged me with attempting to conceal my identity. That is untrue. I am known all along the Olive St. road. I have been unjustly treated in the affair."

A Call for Organization in Philadelphia.

Philadelphia, Pa., Jan. 12.

Editor Horseless Age:

Having noticed an article by Harold H. Brown, in The Horseless Age, issued Jan. 10, 1900, concerning an insurance company which insures owners of automobiles against damages and damage suits occasioned by frightened horses, etc., I would like to ask you to kindly furnish me if you possibly can with the name and address of this company, as I think that the plan is an exceptionally good one. I would communicate direct with Mr. Brown, but he fails to give his local address.

I think that it is about time owners of automobiles in Philadelphia organized an automobile club, and I would be glad to hear from any one in this vicinity concerning the organization of the same, to which I would lend my hearty support. Can

you not urge upon the owners of automobiles in this vicinity the importance of organizing a club?

Wishing you merited success, I am yours truly,

F. L. SWEANY, M. D.

More "Dreams."

New York, Jan. 18.

Editor Horseless Age:

I was very much interested in E. K. S.'s "Dream" on gas accumulators in your issue of Jan. 10. The idea is much older than E. K. S. credits it. F. A. La Roche published an article in the Electrical Engineer in 1891 describing experiments made by him with such a battery. As I remember it, he used an ordinary lead cell with a steel casing, partitioning the upper part to keep the gases separated, and charged it until the gases created a pressure of 300 lbs. The volt meter then showed over 3 volts and the empere discharge corresponded with the excess charged into it. Later he took out a patent.

I understand that Professor Roberts has also experimented in this line and obtained as high as 7 volts with 2,000 lbs. pressure.

I would respectfully suggest that if these gentlemen will give The Horseless Age the results of their experiments they will have many interested readers.

I have had it in mind for a number of years to experiment in this line myself, but the necessary combination of time and opportunity would not come together.

HARRY E. DEY.

MINOR MENTION.

The Avery & Jenness Co., 28 West Washington St., Chicago, Ill., have decided to go into the motor vehicle business.

The Mexican Electric Vehicle Co. has been incorporated at Trenton, N. J., with a capital of $500,000, to operate Lead Cabs in the city of Mexico.

The Coscob Motor & Launch Co., Coscob, Conn., are furnishing marine gasoline motors and launches propelled by same.

Louis Herlicq & Co., 50 Rue de Flandre, Paris, France, would like to represent in France some good manufacturer of motor vehicles and vehicle motors.

W. O. Anthony, Colorado Springs, Colo., is constructing a gasoline carriage weighing 1,000 lbs. The wheels are 30 in. in diameter, fitted with 3 and 2½ in. tires respectively. He is also building a motor to be attached to any ordinary bicycle.

The Bowen Manufacturing Company, Auburn, N. Y., make a specialty of dust-proof self-closing oil cups for automobiles and machinery in general. They are in a position to make prompt deliveries.

M. C. Clark, Kansas City, Mo., is said to be preparing to manufacture motor vehicles there, his plan being to purchase the parts and assemble, and in this way gradually work into the business.

The commissioners of Baltimore parks have decided to admit all kinds of automobiles to the parks, provided the drivers first secure certificates of competence from the general superintendent.

The Michigan Yacht & Power Co., recently organized at Detroit, Mich., with $30,000 capital, will also build motor cycles and automobiles.

The Plass Motor Wagon Co. has been incorporated at Pierre, S. D., with $5,000,000 capital, by Reuben H. Plass, J. S. Reynolds and C. E. Dé Land.

The Oakman Motor Vehicle Co., Greenfield, Mass., have issued a new catalogue giving particular information about the Hertel motor vehicles. They are adding somewhat to the weight to make allowance for rough roads.

The Layton Park Mfg. Co., Milwaukee, Wis., are manufacturing a hub for wire motor wheels, which they claim will carry a weight of 5,000 lbs. with safety. The axles are 1⅜, with 6-in. stub, and the distance between the flanges is 4 in. both front and rear.

William Odlin and Sumner C. Stanley, Andover, Mass., are incorporating the Farmers' & Suburban Jobbing Co. for the purpose of carrying on a general freight transportation business by motor vehicles of any kind between Boston and Lawrence.

The Union Transit Co. has been organized at Paterson, N. J., to build and operate motor vehicles. The capital stock is $200,000 and the incorporators are Isaac A. Hall, George Longbottom, John W. Sturr and John Mallon, of Paterson, and George White, of New York.

Owing to the recent death of Charles J. Clarke, the Autocar Co. will remove from Pittsburg, Pa., to Ardmore, near Philadelphia, Pa., where a plot of ground has been purchased and the erection of a factory begun. Their commodious factory now going up at Swissvale, 8 miles out of Pittsburg, will be completed and sold.

The Detroit Automobile Co., Detroit, Mich., have finished their first delivery wagon, which is now undergoing tests for the collection of mails in that city. The wagon weighs about 1,200 lbs., aluminum and gun metal having been liberally employed in its construction. The axles are of nickel steel. The price of the rig is $1,000. The company has several other styles in process and expects to be turning out 10 vehicles a week by the middle of April.

W. S. Rogers, manager of the Ball Bearing Co., Boston, Mass., is building a motor carriage and has been undergoing experiences in the way of engines, batteries, ignition coils, vaporizers, etc., from several concerns who have "just the thing" and are ready to deliver at once, that have been very interesting, although costly to him. He has promised The Horseless Age a paper on the subject when he has finished the work and those of our readers who have read his pithy sarcasm in other mechanical journals may expect something interesting as well as educational to the prospective builder of motor vehicles.

The Denison Electrical Engineering Co., New Haven, Conn., U. S. A., inventors and builders of an improved and efficient type of two-cycle engine for carriages, launches and various other purposes, have inaugurated one of the most interesting methods of introducing their engine which has yet come to our notice. On receipt of 50 cents they are mailing a working model, together with a technical description of it which cannot fail to be of great interest to any one engaged in gas engine work, as it shows clearly all the principles and theories embodied in this type of engine in addition to describing their own particular methods of construction.

OUR FOREIGN EXCHANGES.

Motor Vehicles.

In Mr. Clegg's article entitled "Explosive Motor Data," in our last issue, he mentioned the paper read by Mr. Alex. Craig at the Cycle Engineers' Institute. The remainder of this paper is appended. It covers not only the subject of ignition in a very instructive form, but also presents some highly suggestive ideas on motors in general.

For the convenience of our readers we have lettered these diagrams, which we will describe with the aid of our notes on the speaker's remarks.

Fig. 1 is a skeleton diagram of the common form of high tension ignition, as used on the Benz car and on some of the earlier forms of gas and oil engines.

Fig. 2 is a similar diagram relating to the De Dion system of ignition.

Referring to Fig. 1, we may consider the current starting from battery A and passing along the wire to the spring B on the insulating rocker N. The end of this spring bears on the single bar commutator C, which consists generally of a metal strip on the periphery of a wood fiber block, the strip being metallically connected to the second motion shaft, with which it rotates. The current thus finds its way to frame work of the car, or in common parlance is grounded each time the strip comes in contact with the end of the spring B. The path of the current through the frame is indicated by the dotted line C D.

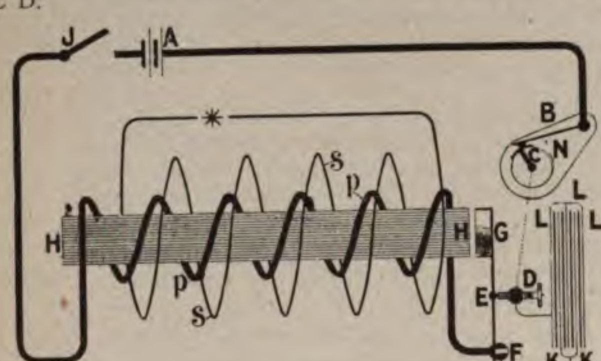


FIG. 1.

D is a brass pillar projecting from the insulating base of the induction coil, and is provided with an adjustable screw tipped with platinum. A spring, F G, is fixed at one end to the pillar F and has at its other extremity a soft iron block, G.

A platinum rivet, E, is placed in the spring, so that when the latter is in its normal position the platinum on the spring makes contact with that on the point of the screw, thus providing a path for the current as far as the pillar F.

From F the primary winding p of the induction coil starts. This consists of a few layers of insulated copper wire, and is wound over a bundle of soft iron wires, which form the core H, whose end faces the soft iron block G. Over the primary coil many layers of fine silk covered copper wire are wound to form the secondary coil, whose ends are connected up to the sparking points.

We have already traced the current to the terminal F, where the primary coil p commences, and it will be seen that when the switch J is closed it has a clear run through the primary coil back to the battery by the wire, which completes the cir-

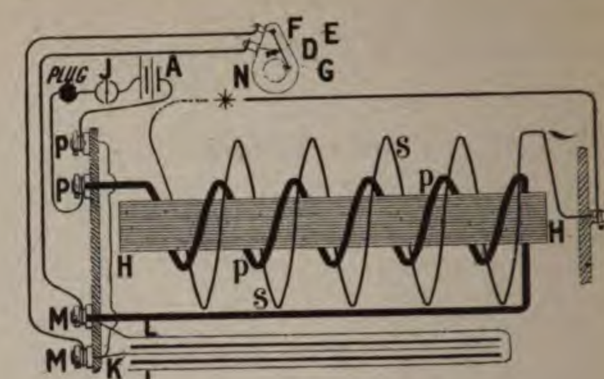


FIG. 2.

cuit. The passage of the current around the primary coil, however, excites magnetism in the soft iron core H, which then attracts the block G on the spring G F, thus breaking the circuit at E, and stopping the flow of current in the primary coil.

This action causes the core H to lose its magnetic force, and the block G, in virtue of the spring on which it is mounted, flies back, and the circuit is remade at E, only to be broken again in the same manner. By careful adjustment of the screw in D a very rapid make and break action may be obtained, which takes place many times while the commutator bar C is in contact with the spring B, and during this period the passage of the battery current through the primary winding is rendered intermittent.

Before leaving the primary circuit, we should consider the action of the condenser K L. This is arranged as a shunt across the contact breaker terminals E and F, and consists of layers of tinfoil separated by paraffined paper. Alternate layers of the tinfoil are connected, as it were, in parallel, as shown, and the thick lines indicate the insulating material.

An electric current, particularly when its circuit includes the coil of an electro-magnet, possesses a property analogous to the inertia of a moving body. When its flow is interrupted, it appears to collect its energy in an effort to jump the gap. This, in the case of the induction coil, would result in a big spark at the contact breaker, were it not for the condenser, which receives extra current, and restores it when contact is again made.

Turning now to the secondary coil S, we find that this has no metallic connection with the primary, and every part of it is carefully insulated, so that the electricity obtained from it is wholly distinct from that supplied by the battery. The current from the secondary coil is a sympathetic or induced one, consequent on the interruptions in the primary current, and the disturbances in the magnetic state of the iron core.

It should be understood that the mere flow of a constant current through the primary coil would not produce a current in the secondary, but that interruptions on the former are necessary.

The function of the induction coil is to produce from a current of electricity of low pressure or voltage another current, which may be small in quantity, but whose pressure or voltage is sufficiently high to enable it to overcome the resistance of the medium between the sparking points and to jump or spark across the gap.

The De Dion ignition is represented in Fig. 2, in which the various parts have been lettered to correspond with those in Fig. 1, whose functions are similar. It will be seen that the coil has no magnetically actuated contact breaker, the current

being interrupted by mechanically vibrating the spring F G. When the notch of the cam on the second motion shaft comes around to the V-shaped black on the end of the spring, the platinum rivet E of the latter comes down on the platinum pointed screw at D, and makes the contact. By careful adjustment of the screw the spring may be made to vibrate, causing rapid interruptions, as in the case of the ordinary coil, but in many cases this result is not attained, and the apparatus simply works as a switch, giving one make and one break, and a good spark can be obtained by this method, especially if the contact surface be made greater.

The path of the primary current can easily be followed from the diagram. For convenience in wiring, the coil is furnished with four terminals in the primary circuit P P and M M, the outside P and M being connected.

Starting from the battery A, we may consider the current as flowing to the terminal P of the coil, and thence to the outside M, which is connected up to the contact breaker pillar F. From this point it finds a passage along the spring to E, through the platinum-pointed screw, to the pillar D, and back by the wire to the other terminal M of the wire. Here the primary winding of the induction coil commences, and, after the current has passed through this, it arrives at the inner terminal P, from which it passes along the wire, through the plug and handle bar switch J back to the battery. The condenser is connected up to the terminals M M.

By comparing the two diagrams it will be seen that the essential difference between the two systems is that in one case the trembler or contact breaker is actuated magnetically, and in the other case mechanically.

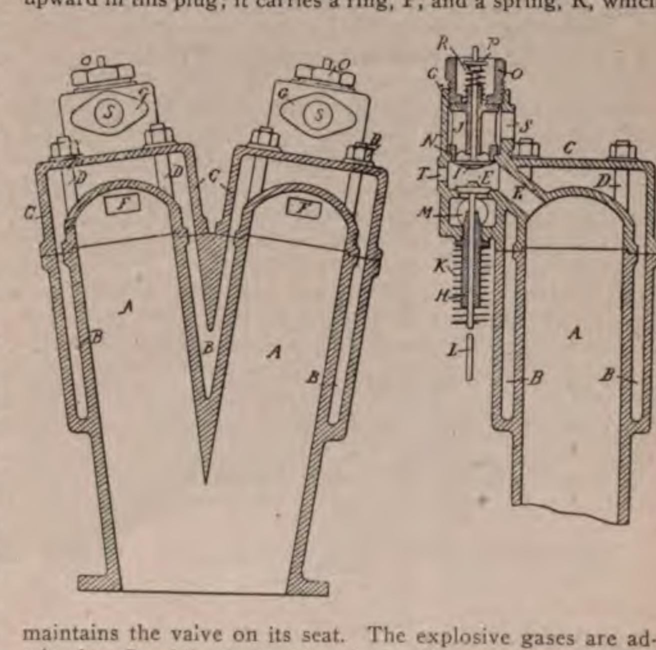
The Daimler-Eldin Gasoline Motor.

IMPROVEMENTS IN THE DAIMLER.

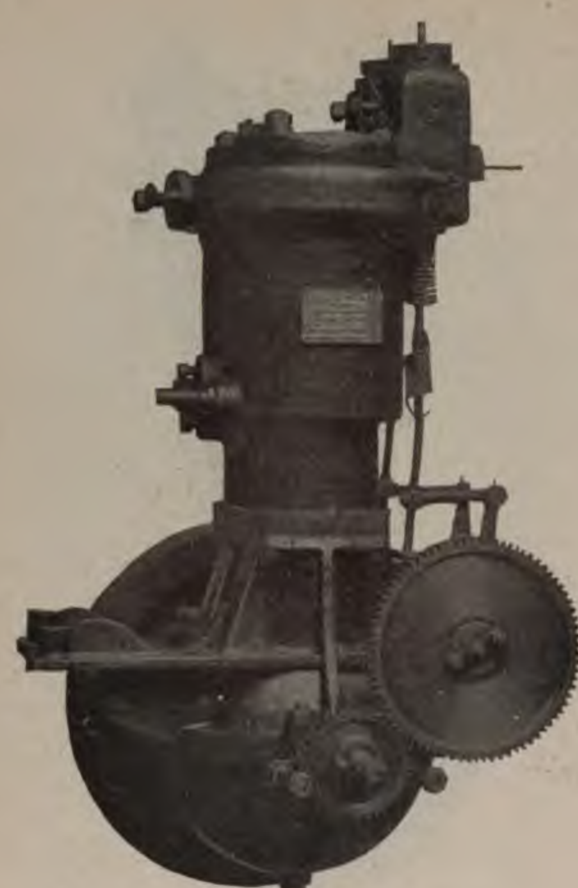
Some improvements in Daimler and Daimler-Phenix gasoline motors have lately been devised by a French engineer—M. A. Eldin, of 20 Place Bellecour, Lyons—by means of which an additional 2-h.p. is claimed to be obtained from existing engines of the type named. M. Eldin states that his improvements have for object: (1) To increase the power with the same volume, (2) to render the cooling of the cylinders more effective by enlarging the water jacket, and (3) to so arrange the valves that they can be instantly withdrawn, and that the springs in connection with same are outside and so removed from the effects of the high temperature inside the valves. Fig. 1 shows a section through the two cylinders of a Daimler motor, while Fig. 2 is a section on the line x y. The two cylinders are cast in one piece with a double jacket, B, covering the whole surface effected by the explosive gases. Walls divide the annular space thus formed around each cylinder, these walls serving as supports to the jacket and into them are screwed the bolts D, by means of which the explosion chambers C are fastened to the cylinders. These chambers are also water jacketed, the water space communicating directly with that around the cylinders. It will be observed that the valve boxes G are placed at the side of the explosion chambers C, a large passage, F, forming the communication between the two. Below this passage is the exhaust valve E, the diameter of which permits of its being placed in position from the top. The rod h of the exhaust valve is guided by a piece, H, the external spring K keeping the valve closed. The admission valve I, before being placed in the box, is fixed in

DAIMLER-ELDIN.

position in a special fitting, J, the two then being adjusted in the box and fixed by the plug O. The valve stem projects upward in this plug; it carries a ring, P, and a spring, R, which



maintains the valve on its seat. The explosive gases are admitted at S, while the igniting device is arranged as usual at T between the two valves. To remove the admission valve it

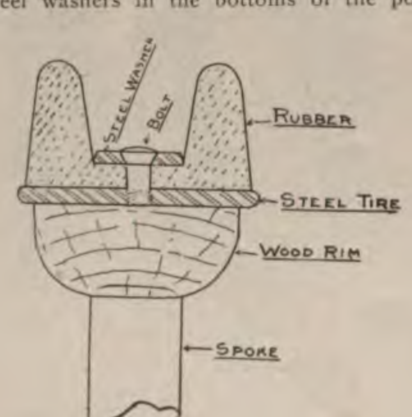


DAIMLER-PHENIX-ELDIN.

is thus only necessary to take off the plug O, while the exhaust valve can also be quickly taken out through the same openings by first releasing the spring K.

A Semi-Pneumatic Tire.

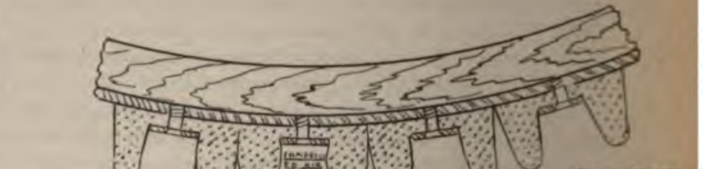
R. E. Olds, of the Olds Motor Works., Detroit, Mich., has recently invented a semi-pneumatic tire illustrated herewith, consisting of a series of open rubber pockets with round corners, fitting on to an ordinary tire by means of screws passing through steel washers in the bottoms of the pockets, and



OLDS' SEMI-PNEUMATIC TIRE.

thence into the steel tire. These washers are vulcanized on to the rubber pockets. The pressure comes betwen two flat surfaces, and there is no cutting edge. When the pocket presses against the pavement the air is compressed in the pocket and its walls thicken, forming a cushion. In passing over an obstruction the rubber expands, it is claimed, and distributes the strain.

Passing Over an Obstruction



Running on Pavement

When one pocket is injured it can be replaced with ease and at small expense.

The Diamond Rubber Co., Akron, O., have brought out a new flat-tread, 5-in. pneumatic of such uniform construction that the strains on all sides are equal and the durability of the tire is assured. Great difficulty has been experienced in curing the four different rubber compounds that are used in the production of these large tires, but they believe they have been successful in accomplishing it and thus making a homogeneous tire.

The "Apple" Gas Engine Igniter.

Manufacturers of gas engines in every portion of the country are adopting the electric igniter and shelving the hot tube. The electric igniter, when properly designed, is much the more satisfactory method, as by its use the ignition can be brought about at just the right point in the cycle. The employment of primary batteries has the objection that there is usually no outward sign that the battery is weakening until the engine begins to miss explosions, and then much time is lost in substituting new cells or in recharging the old ones. Should there be no renewals at hand there may be a delay of several days while waiting for them.

To obviate this difficulty several manufacturers have experimented with small dynamos and also with storage batteries. The objection to the dynamo is that it is not operated until the engine is started, and to the storage batteries that a source of power is required. The advantages claimed for a storage over a primary battery is that it will operate successfully on a closed circuit and that it has but a small drop in voltage as the battery is exhausted. The dynamo and the cheaper form of open circuit sal ammoniac cell have been used in combination, the latter being employed to furnish current until the engine is under way and the igniter being afterward switched on to the dynamo. The objection still remains that the battery must be renewed and taken care of at frequent intervals.

The Dayton Electrical Mfg. Co., Dayton, O., believe they have found an ideal combination for this purpose in a storage battery and a small dynamo, the storage battery being of such capacity that should any accident occur to the dynamo the battery can take care of the work until the dynamo could be repaired or replaced. The combination should be so arranged that the dynamo will charge the storage battery during the intervals between the sparking. Magnetos for this purpose are often more or less troublesome because the permanent magnets are such in name only and will in time lose their magnetism and fail to give current. Another important point to which they call attention is that the dynamo should be of the shunt type in order that there may always be current flowing through the field coils.

We are able to show our readers, in this issue, illustrations of apparatus for this purpose in which the inventor has carried out these principles, and in a manner which we understand has had a successful outcome.

The dynamo illustrated in Fig. 1 is a single coil shunt wound

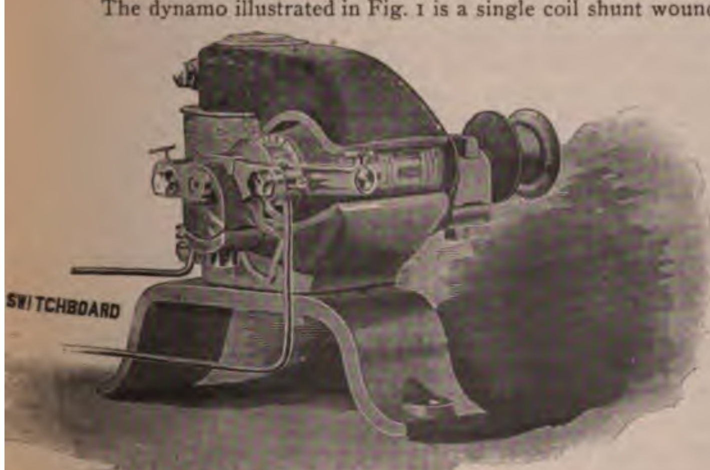


FIG. 1.

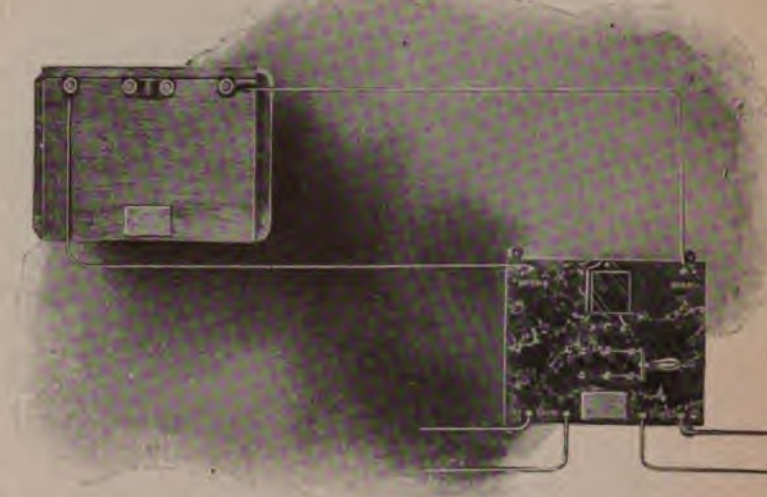


FIG. 2.

machine, designed to give a normal output of from 5 to 8 volts and a current of about 6 amperes. The entire machine is built up on the lines of large generators with a mica insulated commutator and a drum wound armature. The brushes are unique. The carbon is valuable for its lubricating qualities, but is too high in resistance for a dynamo of so low a voltage.

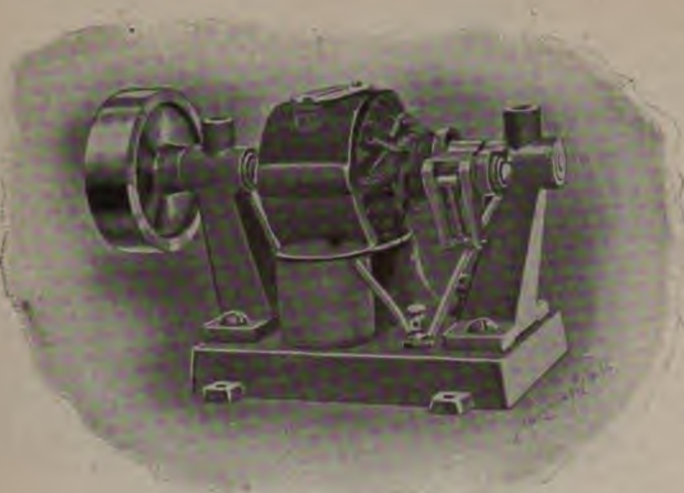
In order to retain the lubricating qualities of the carbon brush and to, at the same time, provide a brush of low resistance, a combination brush is employed, constructed of a cylinder of copper gauze surrounded with a cylinder of carbon. The shaft is ½ in. in diameter and is sufficient to withstand any strains which may be put upon it. It is run in bearings of special design filled with wicking, making a reservoir of sufficient capacity to carry a week's supply of oil.

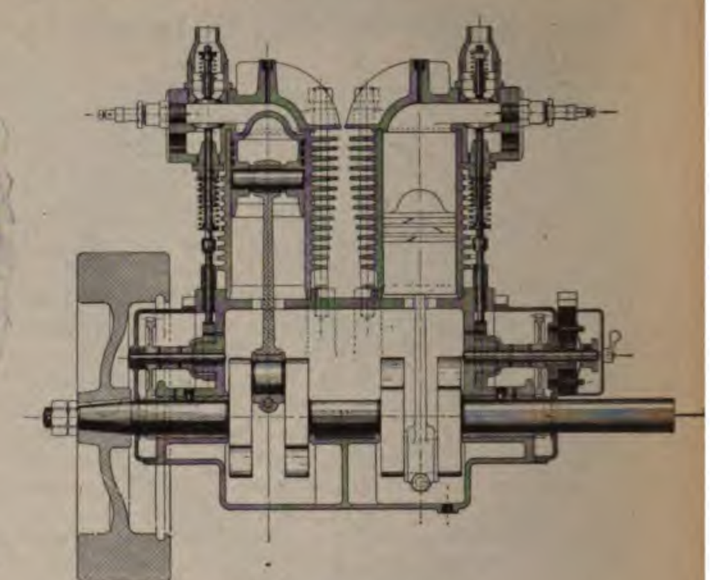
In Fig. 2 is shown a switchboard and battery cabinet which is employed with the dynamo. The dynamo terminals are at the right hand lower corner of switchboard, while at the left hand lower corner are the binding posts from which the current is taken to the igniter on the engine. The battery wires are attached at the top of the board, as may be seen by inspection of the figure. The spark coil is situated at the back of the switchboard. At the center of the top is a buzzer alarm which is so connected that when the engine is started and the dynamo is generating sufficient current for the igniter the switch may be thrown to the position it occupies in the figure, thus throwing the igniter into the dynamo circuit.

The storage cells which are a part of this equipment deserve special mention. The electrolyte is contained in the pores of a jellylike substance which fills the space between the battery plates, and which prevents the liquid being spilled in transport. The grids are strongly constructed so as to prevent buckling and are so designed that the least posible amount of the surface of the lead is exposed to the action of the acid. The connectors are missive, and all lead connections are "burned" on. The cells have a capacity of 40 ampere-hours each, two cells being used for a cabinet.

"New Century" Sparking Dynamo.

A new igniter in the field is the "New Century," sold by L. H. Allen, 2427 Michigan Ave., Chicago, Ill. It is intended to be used in place of liquid primary batteries, and is said to overcome many of the difficulties experienced in igniting the mixture in explosive motors. It weighs 16½ lbs., boxed for





DOUBLE-CYLINDER ENGINE.

shipment, runs at 1,400 to 1,500 revolutions, and is claimed to generate a constant current of 15 volts and 2 amperes, furnishing a bright, hot spark.

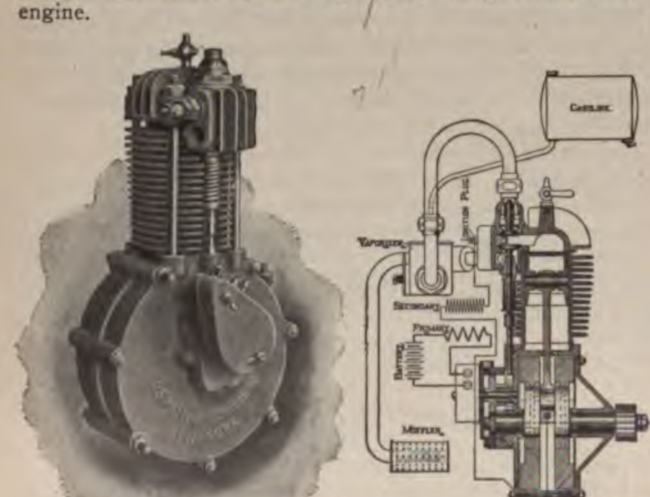
It is necessary to start the motor with a small battery of dry cells and then the dynamo can be switched in by an automatic switch after the necessary speed is attained to produce the dynamo current.

These dynamos, furnished complete with battery, starting set and coil, are intended for wipe sparking contacts with primary coils, but will also operate secondary jump spark coils of certain resistances.

United States Motor Vehicle Co.

The above company, which was organized several months ago, and which owns and controls valuable designs and patents of different types of hydrocarbon and electric vehicles, have nearly completed their first motors and vehicles, and early in February will have three distinct classes or types of vehicles to show in practical service and operation, and which combine many attractive features.

These will be a two-passenger golf trap of very neat and attractive appearance, operated by a 4-h.p. flange-cooled double engine.



SINGLE-CYLINDER ENGINE.

The engine and vehicle in all parts are of substantial construction, yet neat and graceful in appearance.

The variable speed gear on this vehicle, it is believed, will attract special attention, as well as the engine and the general appearance of the vehicle.

The second type of vehicle will be an electric four-passenger trap of the Dos-a-Dos type, in which are combined several new features. An attractive appearance has been aimed at, and at the same time the center of gravity of the vehicle has been kept at moderate height. The vehicle is operated by two motors driving direct to the hubs of the wheels.

The third type of vehicle is a combined gasoline and electric vehicle, but combining a small storage battery and motor of special type and arrangement, so as to give the mobility of handling and control of the regular electric vehicle, with the independence from charging stations of the gasoline vehicle.

This vehicle will be a two-passenger type, of moderate weight, and will undoubtedly attract considerable attention.

It is the intention of the company to sell their motors either with or without the running gear to parties who desire to build their own vehicles. They are completing several types of the flange-cooled cylinder class of motors, which are the result of exhaustive experimenting. One type of the single cylinder, of general design, is shown in the illustration, and one type of the double-cylinder engine.

The double-cylinder engine, illustrated as No. 2, is used for the heavier class of work. It will be noticed that the general construction is very substantial. There are several distinctive features on this engine.

The second type of double-cylinder engine is of somewhat lighter construction, and is used on the company's combination gasoline electric vehicle.

In all these engines, solid forged shafts are used, and they are liberally proportioned in all parts, the company feeling that a little increased weight will be no detriment. The details of valve gear, operating same, controlling electric ignition and the automatic vaporizer or carbureter are said to be entirely new.

The company will have their catalogues, both for motors and vehicles, out by the middle of February, at which time vehicles will be ready for exhibition and inspection from their offices at 1123 Broadway, New York.

MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 640,522—Jan. 2, 1900—Transmission Gear for Self-Propelled Vehicles.—Wm. Baines, London, England.

This invention relates to the transmission of power by rope or cable running in or upon suitable pulleys or drums, preferably grooved for the purpose. This is particularly useful where we have the fly wheel rotating in a horizontal plane, as the rope accommodates itself readily to the change of direction of motion from the fly wheel or engine shaft to that of the road wheels of the vehicle, the pulleys employed for effecting this change of motion being applicable also as jockey pulleys to secure or prevent the necessary tightness of the rope, according as it is desired to drive or to slip. If the fly wheel be not placed upon the engine shaft, but merely connected therewith, the rope may be used as the means of transmission of power from the engine shaft to the fly wheel or to its shaft or boss and either directly or indirectly from there to the countershaft or road wheels. The ropes may be boxed in, if desired; but as they are not so easily affected by exposure to the weather or dirt, this is not of such importance as in the case of belts or toothed gears.

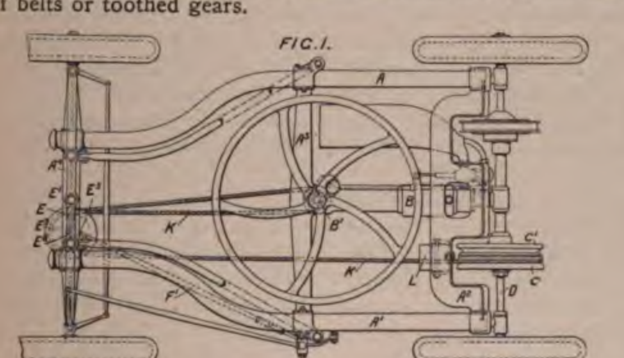
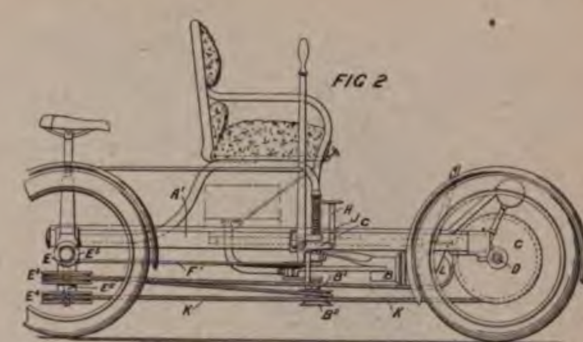


Fig. 2 is a side view.

The main frame of the car comprises side pieces A A′ and cross bars A² A³ A⁴.

The engine B has in this case a vertical main shaft, B′, supported on the cross bar A³ of the frame and carrying the driving pulley B² on its lower end. The driven pulleys C C′ for fast and slow speeds, respectively, are placed on the axle D of the road driving wheels. On the rear cross bar A⁴ of the frame is a horizontal arm, E, one end of which is pivoted on the cross bar by a pine, E′, while its free end is furnished with a vertical pin, E², on which are carried two pulleys, E³ E⁴, free to rotate on said pin. The free end of the arm is also provided with a lug, E⁵, to which is pivotally attached one end of a connecting rod F′. The other end of the rod F′ is connected to one arm of a bell crank lever, G, pivoted on to the side frame A′, the other arm of which is pivoted to a toothed bar, H. This toothed bar H is placed below and in front of the vehicle seat, as shown in Fig. 2, so as to be conveniently manipulated by the occupant of the car, and is carried in a



slotted lug or projection, J, provided with teeth to engage the teeth of the bar. As shown in the figure, the bar H is adapted to be worked by the foot. It is evident it may be arranged for operation by the hand, and may be given a screw action instead of ratchet teeth, as shown.

The driving rope or power transmitter K passes from the driving pulley B² back to the idler pulley E³, and in the arrangement shown in the drawings it is then carried forward beneath a stationary idler L over the driven pulley C or C′, from below which it passes back to the idler pulley E⁴, and thence back to the driving pulley B². By this arrangement a very long rope or equivalent is obtained.

By operating the bar H the power transmitter can be tightened or slackened, as desired. By pressing down the lever the arm E, by the action of the bell crank lever G and connecting rod F′, is swung back, carrying with it the idlers E³ E⁴ and tightening the transmitter, and since four runs of the rope are affected, the amount of slack taken up will be four times the length through which the arm has ben swung. By engaging the teeth on the bar with the corresponding teeth in the slot the arm and its pulleys are held in the desired position, while by releasing the bar H the transmitter is at once slackened.

Flat ropes or belts could be used with this method of driving.

Four claims. Application filed Sept. 18, 1899.

No. 640,393—Jan. 2, 1900—Gas. Engine.—Geo. W. Lewis, Philadelphia.

This invention has for a primary object a practical, simple construction in a single-acting engine adapted to give an impulse at every round.

Fig. 3 is a vertical section of engine.

As shown in the drawing, A designates the frame supporting the various parts of the engine, B a centrally cranked power shaft, mounted in bearings b on said frame and carrying a driving pulley B′, and fly wheels, B² B².

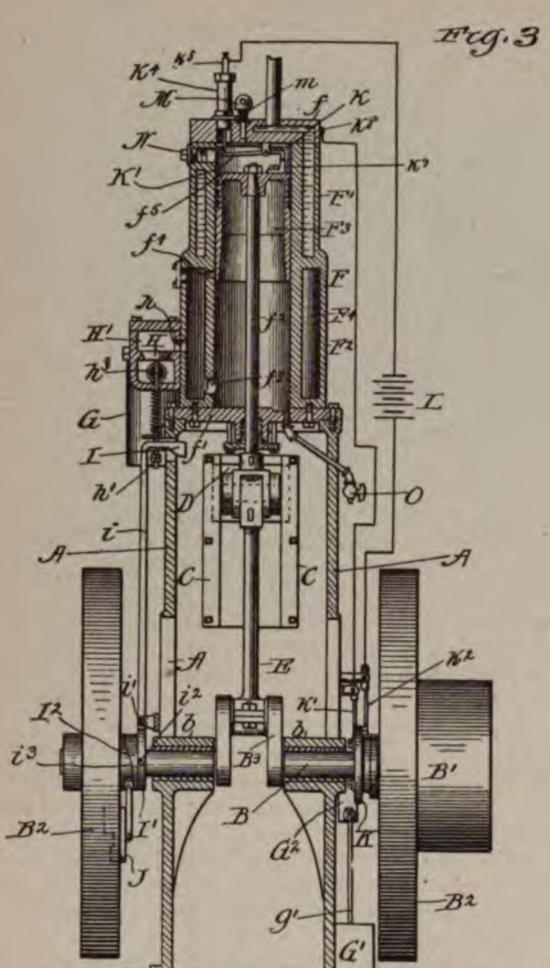
C C are guides for the cross head D, said guides being sesured to the frame, as shown in full lines in Fig. 3, or otherwise.

E is a pitman connecting the cross head D with the crank B³ on the shaft B.

F is a cylinder, of which F′ is the power end, and F² the pump end. Said cylinder F is closed by heads f f′ at both ends, the heads f, closing the pump end of the cylinder, being provided with a stuffing box, through which works the piston rod f², connected, respectively, to the cross head D and to the piston or plunger F³.

G is a carbureter, which in some form will be employed when the engine is intended to use the vapor of a liquid hydrocarbon with air as the explosive mixture.

g is an inlet pipe having a straight portion which passes through the upper head of the chamber for the liquid hydro-



carbon and has its lower end perforated at its sides. The said pipe G is shown as being vertically adjustable within the carbureting chamber.

G' is a supply tank, G^2 being a pump operated conveniently by a peripheral cam on the main shaft B, and connected with the supply tank G' by a pipe, g', and with the carbureter by a pipe, g^2. An overflow pipe leading from the carbureter back to the supply tank is shown at g^3, said overflow pipe being indicated as having its opening within the carbureter at a suitable distance above the bottom of the latter to give the desired or predetermined level to the liquid within said carbureter.

H is a valve for admitting the explosive mixture into the cylinder, said valve, as herein shown, opening directly from the carbureter into the valve chamber or chest H', which communicates with the cylinder. When other gas than hydrocarbon vapor is used, this valve H may similarly admit the mixture of gas which is delivered to it in any suitable manner.

The cylinder F is connected with the chamber F^4, which, as a separate improvement, is shown as being external to and concentric with the cylinder proper or as transverse externally to its lower portion only, said chamber F^4 being in communication with the lower end of the exterior end of the cylinder proper by one or more wide passsages, f^5, and also in communication with the valve chamber H' through one or more passages h. The chamber F^4 is also in communication with the power end F' of the cylinder F when the piston F^3 is at or near the extreme end of its power throw, which is the down stroke. The piston F^3 is shown as being of trunk form in order that the communicating spaces, consisting of a space directly below the piston and the outer space F^4, may be as large as possible in proportion to the space behind the piston after the power stroke has been completed within the least practical limits, the relative proportions of these spaces in the engine shown being about 4 to 1. In other words, the space within the cylinder and below the piston when the latter is elevated or at the end of its compression stroke, plus the space F^4, is about four times the contents of the space behind the piston when the latter has completed its down or power stroke.

One claim. Application filed June 21, 1899.

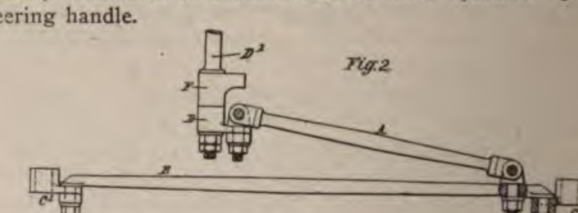
BRITISH PATENTS.

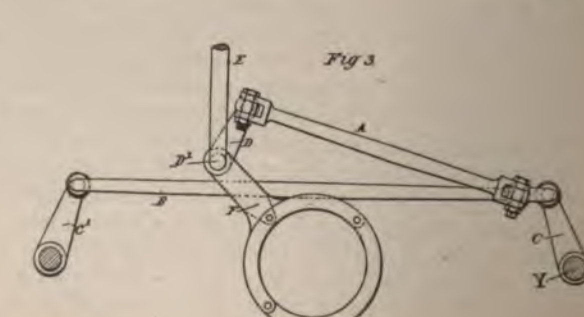
No. 12,600—Nov. 11, 1899—Improvements in or Relating to the Gear or Mechanism for Steering Motor Cars or Motor Vehicles.—The Motor Mfg. Co., Ltd., of 47 Holborn Viaduct, London, and George Iden, manager to the aforesaid company, of Motor Mills, Coventry.

The invention relates to improvements in the gear or mechanism for steering motor cars, special advantages being (1) fewness of parts, and (2) the parts are constructed so as to obviate any danger of the steering gear failing to act in the event of any nuts, split pins or washers becoming detached or loose.

According to the present invention the crank arms are coupled by means of a stout (solid or hollow) rod or connection, advantageously a solid bar in a single piece, having each end of said rod or bar turned down at or about right angles, and such turned down ends screw-threaded and adapted to pass through—so as to be free to turn in—the aforesaid crank arm or lever on each steering wheel, and nuts (and washers) can then be screwed thereon underneath each crank arm or lever, which are thus securely coupled together by this single-piece bar or rod, which for convenience will be termed the "coupling rod."

Toward one end of this coupling rod same has pivoted thereto, or connected by means of a link, or knuckle joint, or eyebolt, or any other suitable means, one end of a rigid connecting rod, which at its other end is similarly or otherwise suitably connected to a crank arm or lever operated by the steering handle.





The shaft of this "tiller crank" or crank arm, is pivoted or journaled in any suitable bearing mounted on a fixed part of the vehicle frame, or otherwise suitably mounted, and the "tiller" itself is rigidly fixed to or formed on said tiller crank shaft, and thereby the movement imparted by the steersman to the tiller will consequently be thereby transmitted to the tiller crank, which latter, through the medium of the aforesaid connecting rod, will thereby operate the aforesaid "coupling rod," which latter will simultaneously turn the pair of steering wheels in the same direction (right or left).

Fig. 2 is an end view in elevation, and Fig. 3 a plan, of the steering mechanism alone on an enlarged scale.

F is bearing (for the tiller crank shaft) fixed to the frame or body of the vehicle.

E is steering handle.

D is tiller crank.

D[1] is tiller crank shaft journaled in bearing F.

A is connecting rod from tiller crank D to the coupling rod B.

B is coupling rod.

C C[1] are crank arms or levers rigidly connected to the hinged or pivoted pins Y Y[1], respectively, which latter are rigidly connected to the shaft or axle of the wheels Z Z[1], respectively.

It will be seen that the connecting rod A at one end is connected from above into the tiller crank D, and similarly at the other end into the coupling rod B, while the latter fits from above into the crank arms or levers C C[1], respectively—so that these parts would remain connected and workable even if their nuts worked loose or came off.

Three claims. Application filed June 16, 1899.

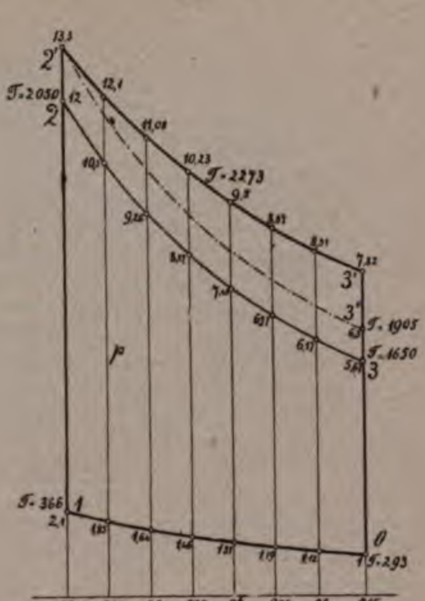
No. 13,103—Nov. 11, 1899—Improved Means for Temporarily Increasing the Power of Combustion Motors.—Eugene Caurvoisier, of Bienne, Canton Berne, Switzerland.

It is well known that in order to produce the motive power in the cylinders of combustion motors, fuel is admitted on one side, and on the other side atmospheric air, used as an oxidizing gas for the fuel, is admitted, and the mixture ignited. For a given size of motor it is possible, indeed, to regulate the work of the engine from zero up to a certain maximum amount, by introducing for the same quantity of air a larger or small quantity of fuel into the cylinder; but by so doing the maximum fuel supply, and, in consequence, also, the maximum work of the motor, is limited by the capacity of the cylinder, while the quantity of air that can be taken up is only able to effect the combustion of a determinate quantity of fuel; when a greater amount of fuel is introduced into the cylinder the surplus is not burnt out and passes through the engine without giving any working effect.

Combustion motors, especially those used for the propulsion of vehicles, are on occasion required to exert greater power than usual, and instead of constructing combustion motors with dimensions required to produce the power greater than is required under ordinary conditions, it would be better to give the motor the proper dimensions necessary for the average requirement, while by so doing the weight of motor would be kept as small as possible, a very material consideration in vehicle motors.

The present invention has for its object to provide means for increasing temporarily the power of the motor, so that it is no longer necessary in constructing combustion motors to consider the greatest power they will be called upon to exert; they can be built according to their average working power.

It is well known that 23.56 per cent. only of the quantity of air introduced into the motor cylinder is at best active during the combustion; the other 76.44 per cent. is azotic gas, and remains as an inert body among this quantity of air. If a mixture of atmospheric air and pure oxygen, or, say, an oxidizing body richer in oxygen than the atmospheric air, is let into the cylinder instead of a given quantity of atmospheric air, it is possible to add a greater weight of fuel to obtain combustion, while more than 23.56 parts of the oxidizing mixture will be acting during the combustion. By increasing the amount of oxygen in the oxidizing mixture the power of the motor can also be increased within certain limits above the maximum power which could be obtained by only using atmospheric air as an oxidizing body for the same motor.



The accompanying drawing is a theoretical indicator diagram of the thermic cycle of a combustion motor, drawn for 1 kilogram fuel mixture, in which the oxidizing agent is supposed to consist of pure atmospheric air only. The combustible mixture is drawn in at a temperature of 20 deg. C., and under atmospheric pressure, and hereafter compressed adiabatically up to 2.1 atmospheres; under this pressure the temperature reaches 193 deg; it is now artificially ignited; the pressure increases to 12 atmospheres and the temperature reaches 1,777 deg; the fuel used is hereby supposed to require 20 kilograms air to effect the combustion of 1 kilogram fuel, with a heating power of 6,000 calories per kilogram. The lighted mixture expands adiabatically, according to the line 2—3, and the surface 0—1—2—3—0 represents the work obtained, which is at the same time the greatest possible work of which the motor is capable when air alone is used. If we now use the same motor and introduce, instead of air, an oxidizing mixture containing 47.12 per cent. of oxygen (instead of 23.56), 1 kilogram of the mixture can effect combustion of 1-10 kilograms fuel against 1-20—i. e., the heat supply resulting from the combustion is greater; the temperature of combustion would rise to 3.284 deg. C. and the pressure would reach 20.8 atmospheres. The temperature of combustion will hardly exceed 2,000 deg. C., as upward of 2,000 deg. C. the particles of the combustion mixture will not chemically combine; the fuel introduced in to the cylinder will merely burn out till the temperature of dissociation reaches 2,000 deg. C.; the corresponding pressure is 13.3 atmospheres. The fuel on hand

can only enter into combination in the same proportion as the heat produced by the fuel particles is neutralized by the cooling resulting from the expansion—i. e., at point 2^1 of the diagram the isothermical expansion begins and the expansion curve 2^1—3^1 is higher than the adiabatic 2—3; the indicated work is now given by the surface 0—1^1—2^1—3^1—0, which is 22 per cent. greater than the other, 0—1—2—3—0.

If the oxidizing medium contains 26.18 per cent. of oxygen it is possible to have in 1 kilogram of this mixture 1-18 kilogram fuel for combustion; the temperature of combustion would reach 2,000 C.; the combustion would still be affected under constant volume, and the expansion go toward the adiabatic 2^1—3''. The temperature at the end of the expansion would then the 1,557 deg. only; the indicated work would be given by the surface 0—1—2^1—3''—0.

According to the kind of fuel utilized, it is evident that an halogen (chlorine, bromine, etc.) could be mixed with air in place of oxygen.

One claim. Application filed June 23, 1899.

No. 18,703—Nov. 18, 1899—Improvements in Motor Cycles.—Theodor Jooss, Munich, in the Empire of Germany.

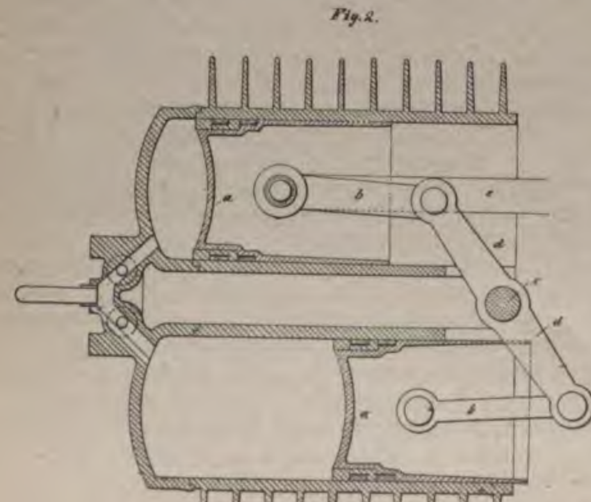
The inventor states that his invention, as distinguished from the motors hitherto known, insures a very easy action, and one free from shocks, owing to a concentration of the parts which is very advantageous to the rider. In the accompanying drawing a form of the invention is illustrated.

Fig 1 is an elevation of a motor bicycle fitted with this invention.

Fig 2 is a sectional view of the cylinders.

Fig. 1.

Fig. 2.



The motor cylinders g h of a twin motor are arranged in the frame of the vehicle so that they lie horizontally one above the other, so that the objectionable oscillations are avoided.

Moreover, the two pistons a are connected together by means of suitable connections, b, with the assistance of a lever, d, oscillating around a pin, e, this arrangement being intended to insure an exact alternate action of the pistons, whereby the motor is equilibrated.

For the two cylinders only a single crank, to which the connecting rod c runs, is necessary.

It is obvious that this arrangement is also suitable for vehicles with several riders.

The claims are:

1. Improvements in motor cycles, distinguished by motor cylinders g and h, arranged in the frame of the vehicles, lying horizontally one above the other in the longitudinal direction thereof, for the purpose of insuring an easy action, free from shocks.

2. In motor cycles, as claimed under Claim 1, the means for connecting together the two pistons a, consisting of suitable intermediate connections, b, and a lever, d, oscillating around a fixed pin, e, for the purpose of insuring an exact alternate action of the pistons, and thereby the equilibration of the motor.

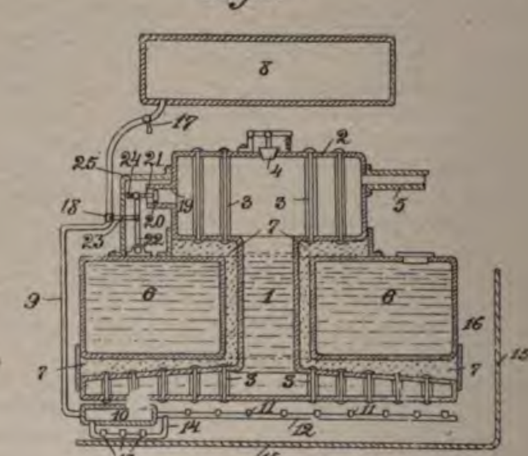
Application filed Sept. 16, 1899.

No. 20,245—Nov. 18, 1899—Improvements in Connection with Tram Cars, Motor Cars and Like Vehicles for Removing Persons and Animals from the Path of and Preventing Them Being Run Over by Such Vehicles.—Bryan T. Emett, Dover, in the County of Kent.

This is a spring fender and is described in the inventor's two claims thus:

1. A fender or guard for tram cars, motor cars and other vehicles, comprising jointed sections, which, when the fender

Fig. 1.



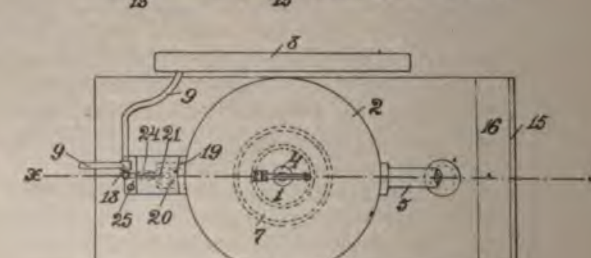


Fig. 2.

or guard is in use, screen the draw gear, under gear, and wheels of the car on which it is mounted, said sections, or some of them, being capable of yielding against the action of springs when meeting an obstruction, and of being folded up so as to enable the draw gear to be used, or the road space occupied to be reduced, substantially as described.

2. A sectional spring lattice work fender or guard for tram car, motor car and other vehicles, constructed, arranged and operating substantially as described.

Application filed Oct. 9, 1899.

No. 21,426—Dec. 2, 1899—Improvements in and Relating to the Construction of Auto-Motor Vehicles.—Paul Gallet and Georges Maxime Itasse, Boulogne sur Seine, in the French Republic.

The present invention has for its object to construct a frame or under carriage, which will be applicable to all varieties of motor vehicles.

Fig. 1 is a side elevation of the carriage.

Fig. 2 is a section of the rear suspension means of the carriage and frame.

Fig. 3 is a section showing the fore suspension of the carriage and frame.

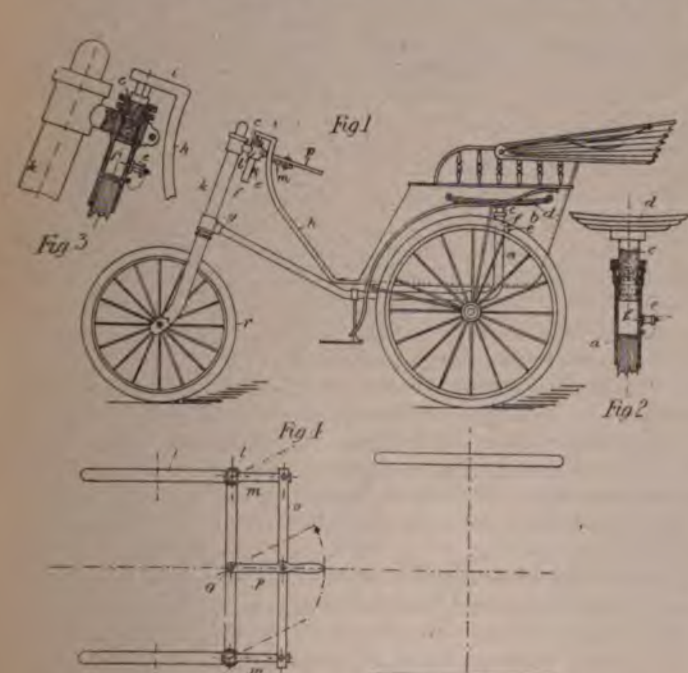
Fig. 4 is a plan giving details of the steering connections.

The entire frame is made of steel or other metal tubes lined with wooden rods or disks, preferably Malacca or Bois des Indes; but any other species of wood may also be utilized.

The wood pieces inside the tubes are suitably connected with each other and keyed at the joints, or special wedges at the ends; finally, they are pinned. Owing to this lining, all the carriage frame is extremely solid, and at the same times very elastic.

The rear part of the carriage frame is not fixed directly to the body itself, but is connected with this said body by an elastic means of some kind such as a spiral spring, or leaf spring.

In the drawing we give the connection made by aid of a



Giffard compressed air cushioning joint. For this purpose a piston, c, is dependent upon springs, d, fixed to the carriage body b. This piston c enters through a suitable stuffing box into the top part of the frame a, which forms an air cylinder. A valve, e, is situated on this top part to enable introduction of the compressed air into the cylinder, f.

The frame a is supported in the fore part by lugs, g, which surround the steerage tubes. The body b itself is dependent on an apron furnished on each of its sides with two rods, h, which at their top part, i, carry pistons similar to the rear piston c. These pistons work in compressed air cylinders, f, similar to that above described.

By this arrangement the entire body of the vehicle is only supported upon the frame either by the intervention of springs or compressed air pistons and cylinders; consequently its elasticity is very great and the smoothness of its travel is considerable.

At the top part of each of the steerage rods k there is a socket, l, connected by a bar, m, with transverse bar, o.

A handle, p, unites the entire parallelogram thus formed; it is movable around the fixed point g. By displacement of this handle p we can easily see that the two rods m will be displaced, constantly remaining parallel with each other; the sockets l will then always turn to the same extent and the two steerage wheels r will take equal inclinations.

One claim. Application filed Oct. 26, 1899.

No. 18,051—Nov. 11, 1899—Improvements in Driving and Speed-Changing Mechanism for Motor Road Vehicles.—James Craig, New York city, N. Y., U. S. A.

The invention consists in providing a suitable frame or casing for the motor and motor mechanism, in which is mounted one or more gears adapted to be actuated by the motor, the said frame or casing being provided with eccentric bearings in which is journaled the driving axle of the vehicle; and in providing a means for rotating said eccentric bearings in said frame or casing, whereby the driving axle and the motor casing move relatively to each other, thereby permitting one or the other of the gears mounted in the casing or frame to be thrown into or out of operative engagement with the gear on the driving axle of the vehicle without the use of clutches. These gears may be arranged to give different speeds to, or reverse the direction of, the vehicle.

Eight claims. Application filed Sept. 6, 1899.

No. 16,115—Nov. 25, 1899—Improvements in Clutch Mechanism for Use in Connection with Cycles, Motor Cars and Other Vehicles.—James F. Freeman, Balsall Heath, Birmingham.

The improved clutch mechanism consists of a friction ring revolving in an outer ring or wheel; the friction ring is provided with a series of slots, such slots being formed into inclined planes; into each slot in the friction ring is placed two or more rollers or two or more balls; such rollers or balls roll on the inclined planes, and when in action engage themselves between the inner portion or friction ring, and the outer portion, so as to form a connection for the transmission of power to the outer portion, outer ring or outer wheel.

Three claims. Application filed Aug. 8, 1899.

No. 21,124—Dec. 2, 1899—Improved Steam Motor Carriage.—Vilma Papp and F. Becker, Buda-Pesth, Hungary.

The first named inventor, be it known, is described as a gentlewoman.

The invention is described as follows:

Fig. 1 is a vertical section through the boiler taken on line x—x of Fig. 2, which is a plan of the said boiler.

The steam boiler 1 is formed flat at the bottom and provided with a steam dome, 2, connected to the bottom by the neck part 1. The parts are strengthened by means of stays, 3. The safety valve is indicated by 4 and the steam outlet to the engine by 5. 6 is a water tank arranged around the boiler tank so as to leave a space, 7, between it and the boiler plates, which is filled up by some heat retaining agent, such as ashes or the like. 8 is a petroleum reservoir connected by a pipe, 9, to the heater or gas generator 10, whence the gas generated is conducted along a pipe, 12, to jets or burners, 11, below the boiler. A branch pipe, 14, having burners, 13, is conducted underneath the heater 10 and serves to heat the same. A plate, 15, incloses the bottom and sides of the boiler and water tank and forms the chimney 16 for the fire space. The pipe 9 is provided with a cock, 17, which may be manipulated by hand, and with a second cock, 18, which is automatically controlled by means of a piston, 20, mounted in a cylindrical extension of the dome 2 and having a piston rod, 21, guided in a bracket, 25, and having a spring, 24, mounted around it between the pivot joint, with a lever, 22, and the bracket 25, said spring being adjusted to keep the piston in its normal position with the valve open when the steam pressure is at the proper height. The lever 22 is pivotally mounted at its lower end on the water tank or other suitable part, and is connected by a link, 23, with the lever of the cock 18, which it controls. When the pressure in the boiler dome exceeds the normal height the piston 20 will be forced outward against the action of the spring 24 and will wholly or partially cut off the petroleum supply to the heater 10, thus regulating the flames which heat the boiler and serving to keep the steam at its normal pressure.

Three claims. Application filed Oct. 23, 1899.

No. 1,706—Nov. 25, 1899—Improved Clutches for Connecting Loose Gear Wheels or Pulleys to Shafts for Motor Cars and Other Machines.—H. W. Clark, Daisy Bank, Middleborough Road, Coventry.

The clutches consist of feathers, F^1 F^2 F^3, fitting loosely in recesses of bearings of wheels W^1 W^2 W^3, Fig. 1. Feathers F^1 F^2 F^3 are pressed against shaft A by springs (for example, P^1 P^2 P^3). In shaft A are slots S^1 S^2 S^3. When shaft A is slid through bearings into such a position that the feather F^1 F^2 F^3 in the bearings of one of the wheels enter the slots S^1 S^2 S^3 in shaft A the wheel is thereby connected with shaft.

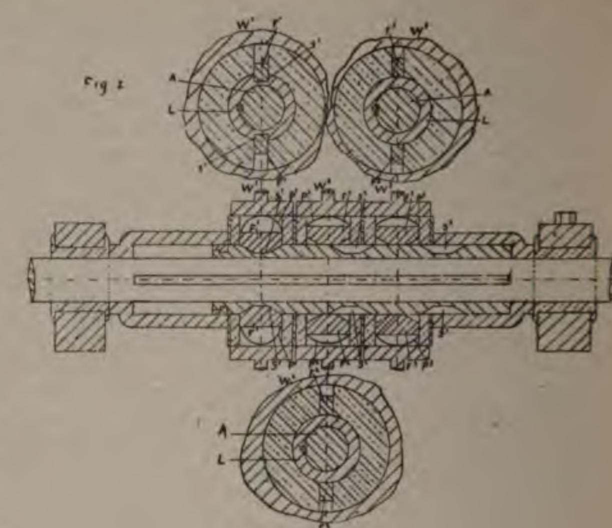
Slots S^1 S^2 S^3 are so shaped that when shaft A is slid along, feathers F^1 F^2 F^3 can be drawn in or out of the slots S^1 S^2 S^3, as required, thereby connecting or disconnecting wheels. Fig. 1 shows portion of three wheels in section, each of which contains in its bearing two clutches, and the shaft with corresponding slots.

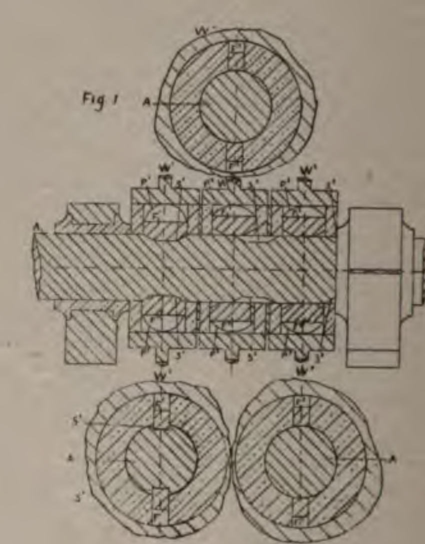
Wheel W^1 is shown connected to shaft by feathers F^1.

Wheels W^2 and W^3 are shown with clutches released.

Fig. 2 shows feathers F^1 F^2 F^3 contained in recesses in bearings, which feathers are pressed by springs P^1 P^2 P^3 against a sleeve which is placed upon shaft A.

Should circumstances prevent the sliding of shaft, shaft A shall have upon it a sleeve, L, which cannot rotate independently of shaft A, but can be slid along it. On sleeve L wheels W^1 W^2 W^3 can rotate until sleeve L is slid into such position that the feathers F^1 F^2 F^3 in the bearings of one of the wheels W^1 W^2 W^3 are pressed by the springs P^1 P^2 P^3 into the slots S^1 S^2 S^3 in sleeve L. Thereby any one of the wheels W^1 W^2 W^3 may be connected with shaft A.





The shape of the slots S^1 S^2 S^3 in sleeve L is such that when sleeve L is slid along, feathers F^1 F^2 F^3 can be drawn in or out of slots S^1 S^2 S^3 in sleeve L.

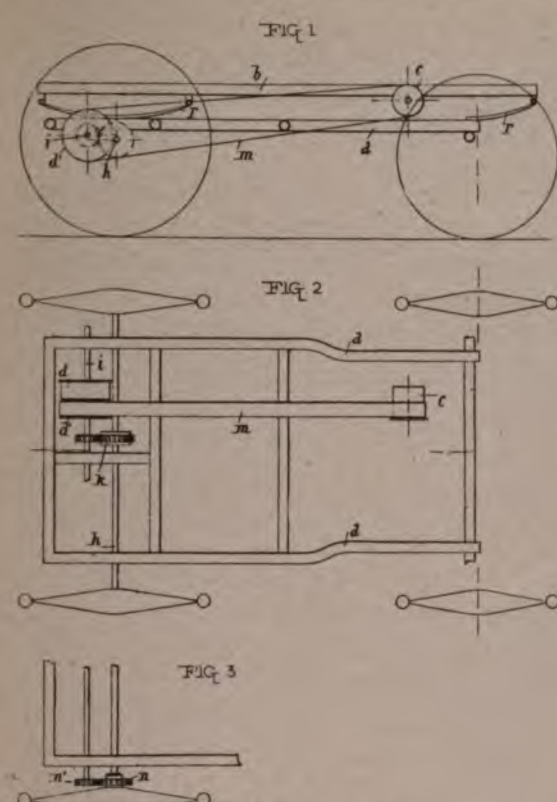
There may be any number of such clutches to each gear wheel or pulley, and any number of wheels or pulleys containing them on a shaft or sleeve.

Application filed Jan. 25, 1899.

No. 4,320—Improvements in Motor Road Vehicles.—George Marks, of 18 Southampton Buildings, London, W. C., consulting engineer (a communication from abroad by M. Gaston Boutitie, of Bayonne, France).

This invention has for its object to so provide a motor vehicle that the motor shall not be subject to the shocks incidental to irregular surfaces, and so that the gearing shall be noiseless in operation.

The invention consists in mounting the motor upon a superposed frame supported upon an under frame by means of springs, and in the employment of belt gear to communicate motion from the motor to the driving mechanism, which belt gear is relatively long.



An under frame is provided upon which a second frame is mounted, carried upon the under frame by means of springs. The motor is mounted upon the superposed frame near the front end of the vehicle and communicates motion to a secondary shaft mounted in proximity to the rear driving axle. A loose pulley is mounted upon this secondary shaft upon which the belt may be caused to pass from the adjacent fixed pulley to disconnect the motor. Motion is communicated from the secondary shaft to the driving axle through differential gear or an equation box centrally disposed upon the driving axle. The motion may, however, be communicated to the driving wheels by the provision of toothed wheels integral with the hubs of such driving wheels, with which toothed wheels pinions provided upon the extremities of the secondary shaft may gear, thereby obviating the employment of a rotating axle.

One claim. Application filed Feb. 27, 1899.

No. 1,149—Dec. 2, 1899—Improvements in Motor Road Vehicles.—J. F. Gommeret and Leon Gommeret, of Troyes Department de l'Aube, in the Republic of France.

The improvements in motor vehicles enable the vehicle to be steered in the same manner as where animal traction is employed, by means of reins; they also permit of stopping the vehicle suddenly and causing it to travel backward instantaneously, to vary its speed automatically and progressively, of rendering the motor independent of the organs of locomotion, of starting it by means of compressed air without displacement on the part of the driver, and, finally, of obtaining, by the arrangement of the transmission parts driven by belting, relatively smooth motion. The improvements which relate more particularly to the motor enable its speed to be regulated and altered, insure the compression of the mixture, and the exhaustion of the burned gases immediately they have produced their effect, thus reducing the heating of the cylinder.

The motor vehicle is provided with wheels of an improved type, which present the advantage of great durability, of being inexpensive to maintain and of traveling smoothly and noiselessly.

In addition to this, the vehicle itself presents certain constructional peculiarities, more especially with respect to the steering mechanism, upon which is adapted an allegorical figure resembling the fore part of a horse, the head of which is provided with bells for the purpose of warning foot passengers and giving notice of the approach of the vehicle. This figure facilitates steering by observing whether the head thereof is central.

The invention further relates to the continuous lubrication of the transmission parts, the automatic feed arrangement for the carbureter and the alternating arrangement of the air reservoir.

This patent covers some 19 figures, etc., and in the limited space we cannot describe the fanciful complications at length.

Application filed Jan. 17, 1899. Twelve claims.

No. 509—No. 11, 1899—An Improvement in Steam Omnibuses.—Sidney Straker, 110 Cannon St., E. C., declares the nature of his invention to be as follows:

Usually, in order to prevent annoyance to the outside passengers of a steam omnibus, the top is roofed over and the chimney is extended above the roof. This is objectionable on account of weight and cost, and the clumsy appearance given to the vehicle.

This invention roofs over the seat of the engine driver, which is usually low down, so that its roof will be approximately level with the roof of the omnibus, and extends the chimney through this roof and a little beyond it. Behind the chimney, in front of the roof seats, is fixed a screen of sufficient height to shield the passengers seated on the roof of the omnibus from the fumes issuing from the chimney.

One claim. Application filed Jan. 9, 1899.

AUSTRALIAN PATENTS.

From Phillips, Ormonde & Co., patent and trade mark agents, 533 Collins St., Melbourne, Victoria, who are in possession of all information that may be wanted.

No. 16,749—Vaporizer for Oil Engines.—J. Taylor, of 99 Queen St., Melbourne, Victoria, engineer. In the Colony of Victoria.

No. 16,802—Relating to the Transmission Gear and Motor of Self-Propelled Vehicles.—E. W. Rudd, of North Road, Caulfield, Victoria, merchant (communicated by W. Baines, of 40 Holborn Viaduct, London, England, financial agent). In the Colony of Victoria.

No. 16,667—Brakes for Road and Other Vehicles.—A. Stevens and W. S. Penny, both of 99 Cannon St., London, E. C., England, boatbuilders. In the Colony of Victoria.

No. 16,676—Internal Combustion Engines.—R. Diesel, of 2 Schack Strasse, Munich, Germany, engineer. In the Colony of Victoria.

No. 16,693—Motor Cycle and Petroleum for Use Therewith.—P. A. Renaux, of 33 Rue du Repos, Paris, France, engineer. In the Colony of Victoria.

No. 9,727—Brakes for Motor Cars, Gun Carriages and Other Vehicles.—A. Stevens and W. S. Penny both of 99 Cannon St., London, England. In the Colony of New South Wales.

No. 5,200—Motor Road Vehicles.—R. Hagen and C. Fronhaeuser. Queensland application.

No. 12,021—Hydraulic Steering Gear for Traction Engines.—H. A. Flatman, of Lincoln Road, Christchurch, New Zealand, engineer. In the colony of New Zealand.

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

SPECIAL OFFER.

BACK NUMBERS.

We have no more complete files and have decided to offer miscellaneous back numbers of THE HORSELESS AGE, from December, 1895, to March, 1899, at the following prices:

12 Assorted, - - - $1.00

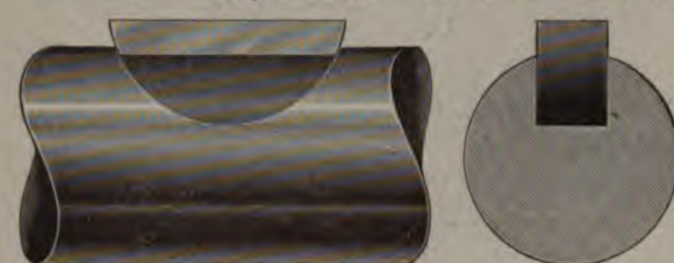
6 " - - - - 50 cents.

Foreign, 5 and 2½ shillings, respectively.

THE HORSELESS AGE,

American Tract Society Building, **NEW YORK.**

Nassau and Spruce Streets,



THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. V. NEW YORK, JANUARY 31, 1900. No. 18.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, \$2.00 a year, in advance. For all foreign countries included in the Postal Union. \$3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

No Pet Theories.

Neither of the editors of The Horseless Age has any pet theory which he is endeavoring to shield from inquiry. Our sole object is to build up a profitable technical journal in the department of horseless locomotion. We believe ultimate success will be best achieved by a broad, independent and fearless policy, whose aim is the searching out and encouragement of the truth, wherever we may find it. In the formative period of an industry, when the charlatan and the enthusiast are generally noisiest and most numerous, the truth seeker cannot look for popularity, but with the winnowing of time his motive should be better understood, for endurance is the proof of merit in trade, as it is of virtue in character. The law of the survival of the fittest is here, as elsewhere, paramount, and to assist this law, by exposing the false and commending the true, is the privilege and the duty of the journalist. The more thoroughly this policy of discrimination is carried out the sooner will the industry for which we are all striving be an accomplished fact.

We invite criticism from all intelligent sources. We offer no views for which we are not prepared to give satisfactory reasons, but neither the editor nor his contributors are infallible. Though differing in their opinions on minor details of motor vehicle construction, our staff is a unit in its aversion to sham, humbug and concealment. To these we give no quarter, but to honest inquiry we extend a friendly hand. We repeat, we have no pet theories to coddle. Our facts we dig for in the workaday world; our philosophy has been wrung from it.

Bicycle and Motor.

Those who attended the Cycle and Automobile Show at Madison Square Garden last week had a good opportunity to witness two things—the eager interest of the public in the motor vehicle and the essential difference in construction between the bicycle and the motor vehicle. The two-wheeled machine propelled by man presents an entirely different problem from the four-wheeled machine driven by a motor. The first, from the very fact that it is propelled by human muscle, must be reduced to the extreme of lightness and confined to fairly good roads. The strains to which it is subjected are all in the plane of the wheel—i. e., vertical, and, therefore, much more easily accounted for than the severer and more diverse strains that rack the four-wheeled structure throughout all its parts. Added to this diversity and intensity of strain is the problem of the motor and the transmission of power under the excessive shocks, the dust and dirt and the varying demands of road service, and the steering in crowded thoroughfares, and at high speeds. The problems encountered in the motor vehicle are therefore entirely new, and unlike those met by the builders of bicycles. No better evidence could be had of the truth of this statement than some of the vehicles exhibited at

the Cycle Show, in which the adherence to bicycle traditions was most plainly marked. The primary object of the bicycle mechanic who undertakes to construct a motor carriage seems to be to build the lightest machine that will hang together until it is sold, without any reference to the work it is to perform. Such flimsy toys are a detriment to the industry. They lead the public astray on the two important points of weight and price, breed dissatisfaction among purchasers and failure among manufacturers. In these days of cheap books and universal knowledge, it would appear as though the veriest tyro in the business might familiarize himself with the A B Cs of engineering, learn something of the strength of materials and the intensity of strains in similar service, and so avoid such foolish blunders. There are enough mistakes in detail to be made without running blindly into the old and traveled ruts of error.

We believe all well-posted students of the motor vehicle will agree with us when we assert that the sooner and the more completely the bicycle and the motor vehicle are divorced both mechanically and commercially, the better it will be for the latter.

Care of Storage Batteries.

Among the many sins of omission that may be laid at the door of the manufacturer of electric vehicles is the neglect to provide his customers with suitable instructions in regard to the charging of batteries. In no instance, so far as our knowledge goes, has this most necessary knowledge been imparted by the makers. The customer or the employee into whose hands falls the care of the vehicle is wholly ignorant of the delicacy of the apparatus on which his motor depends for a supply of the electric current. Misguided by the wild talk of promoters, styling themselves electrical engineers, he undertakes to charge his battery in an hour or two, overheats his plates, and soon destroys them, when with intelligent care they would render satisfactory service. The electric cabs and delivery wagons in service in New York to-day afford constant and shameful evidence of the wanton destruction of storage batteries through the ignorance of those who handle them. This culpable ignorance is directly traceable to the promoters, who have been occupied in selling stock rather than in educating their customers or employees in the proper use of their vehicles. The electric vehicle is delicate, costly and troublesome enough with the best of care; carelessly handled, it is a ruinously expensive toy.

Honest Horse-Power.

We have already called attention to the tendency on the part of American manufacturers of gasoline vehicle motors to overrate the horse-power of their product. Many no doubt are overmastered by the inventor's enthusiasm in advertising their new-fledged creations, and fail of accuracy in their arithmetical calculations, owing to their haste to get into the market. Others, it must be confessed, seem ignorant of the meaning of the mechanical term, horse-power. Similar exaggeration has been practiced in France, and to it we owe the horse-power tests recently carried out with so much success by our esteemed contemporary, La Locomotion Automobile. Our own manufacturers, too, should be brought down to solid facts as soon as possible, and public competition under the management of some neutral body is the best way to accomplish it. It is much to be desired, therefore, that the first of the public trials which the Automobile Club of America proposes to hold should include tests of a nature to determine accurately the actual horse-power of vehicle motors sold and in use in the United States to-day, and to formulate simple rules by which the horse-power of motors may easily be computed.

Present Tendencies in Gasoline Vehicle Manufacture.

In regard to present tendencies among gasoline vehicle manufacturers in the United States, the general drift is toward variable speed motors of higher power, simplifying transmission and reducing weight to a minimum. The jump spark apparently has the preference over the wipe contact, but in reference to the number of cylinders it is best to employ a difference of opinion prevails. Many prefer the single cylinder, arguing that the ignition and valve mechanism are simpler, and, with proper construction, the vibration is little greater than in the two-cylinder balanced type. Many good makers, however, have adopted two or even three cylinders in higher horse-powers in order to lessen vibration and facilitate the cooling of the cylinders. Attempts to dispense with the water jacket altogether in carriage motors (as distinguished from tricycle motors) have so far proved unsuccessful, but the employment of condensers so placed as to be exposed to a constant current of air has greatly reduced the supply of cooling water carried. There is still a deplorable exaggeration of horse-powers on the part of some makers of limited mechanical experience, and a foolish tendency to strive for lightness at the expense of strength and durability. Horse-powers calculated theoretically in the shop at top speed do not materialize upon the road, and when to the shocks of the explosions are added the strains of the road, the necessity for sturdy construction must be apparent even to the novice. Road vehicle service is the most exacting to which a motor may be put.

"Whoa, Boy!"

A subscriber, who has driven a motor carriage over 6,000 miles, says he has found that the best way to quiet a horse showing fright at his motor is to speak to it. The sound of a human voice coming from the object of his terror seems to re-

assure the animal and quiet his fears. Very often the driver of the horse is too much absorbed in looking at the motor to speak to his animal himself, or has lost his presence of mind altogether at the strange spectacle. But the voice of the operator of the machine apparently has the better effect, because it dispels the ghostly idea from the horse's brain and proves that the vehicle, though horseless, has a human occupant. Any of the familiar expressions, such as "Whoa, boy!" or "Whoa, there!" will answer the purpose.

Ball Bearings the Crucial Point.

A gentleman who has been running a light steam carriage with much satisfaction for the past six months states that he believes the chief source of trouble in carriages of this type is the bearings, and if the balls are taken out and new ones put in once a month or so, many troubles would be avoided. The cost of the new balls is slight, and the labor attending renewal is not great.

Lead Cab Damage Suit.

A suit for damages is now being tried before Judge Dugro and a jury in the Supreme Court at New York city, in which the Electric Vehicle Co. is defendant.

The action is brought in behalf of Ellen Dooley, 18 years old, to recover $25,000 damages for injuries she received in June, 1898. She claims that she was then seated on the stone coping in front of a residence at Park Ave. and Thirty-ninth St., when one of the Lead Cabs of the company, beyond control, ran up on the sidewalk at full speed, striking her and fastening her to the railing. She has not been able to leave the house since, it is said. She was too ill to be brought to court, but the clothes she wore on the day of the accident were exhibited to the jury.

Evidence was introduced to show that she suffered a severe shock to her nervous system, in addition to being bruised and badly injured, and her spinal cord is also said to have been so injured that her present condition may be permanent.

Altham Motor Co.'s Troubles.

William W. Coe, late treasurer of the Altham International Motor Co., Boston, Mass., has been arrested on a charge of larceny, preferred by a Boston investor in the company. The company's affairs have been placed in the hands of a receiver on petition of George J. Altham, president, and inventor of the motor which was being developed. The receiver is Charles F. Allen, of Haverhill, Mass., who states that Coe, by his questionable transactions, has secured control of a large amount of the stock and real estate of the company, to which he is not entitled. A compromise, involving a mutual surrender of all obligations on the part of Coe and the company, is proposed and will probably be effected.

The stockholders, who are scattered throughout New England, have full confidence in Mr. Altham, and are hopeful that the company's affairs will be disentangled.

Automobile Patents.

A compilation has been made by James T. Allen, Examiner of the United States Patent Office, of all patents on vehicles propelled by electricity, gas, steam, spring or other power, granted in the United States from 1789 to July 1, 1899. The volume will contain photographic reproductions of all the drawings of the patents, together with a description of the nature of the invention, the essentials of the specifications, the claims in full and a complete index; also a list of all references cited when the patents were pending, and of interferences, parties to them, and decisions. The compilation will also include complete illustrations of all patents regulated and classified under traction engines, portable engines, traction wheels, electric locomotives and other classes of an analogous character, not strictly pertaining to the automobile industry. The volume will contain a digest of about 500 patents.

Minor Exhibits.

Among the minor exhibits of interest to the motor vehicle constructor at the Cycle and Automobile Show were the transmission of Colcord Upton, Beverly, Mass., and the Standard Cap Valve, adaptable to any valve now in use. It has a rubber to rubber seat, no springs, and as all the mechanism is in the cap, the valve barrel can be vulcanized into the tire when it is moulded. It is manufactured by the Standard Valve Co., 136 Liberty St., New York. The Auto-Electric Air Pump, an automatic air compressor, operated by electricity, and recommended for filling tires, was shown by the Auto-Electric Air Pump Co., 39 Cortlandt St., New York, while there were acetylene and oil lamps galore, noticeable among them being the self-regulating acetylene lamp of the Plume & Atwood Mfg. Co., called the "Banner." A pneumatic tire, said to be non-puncturable, was shown by the Preston Hose & Tire Co., Everett, Mass. The novelty in the construction is described as follows:

"The tire is constructed on an entirely new and novel plan (an elliptic spring), the machines weaving the fabric being built expressly for that purpose. This fabric is a seamless, circular, woven, solid tube, with one or more reinforcements so placed as to form an ellipse, each reinforcement being solidly woven to the main tube and running from the main body in layers about ¼ in. between the edges of each reinforcement. The different layers of reinforcements, on the tread of the tire, are so arranged that each warp thread, where the reinforcement comes, lays in the crease of warp threads of the under fabric, and are tied together with the 'tiethreads' running over and under the warp threads instead of directly through, as is the case with all woven fabrics."

The Metallic Rubber Tire Co., 210 Center St., New York, exhibited a tread for pneumatic tires designed to prevent slipping and lessen the danger of puncture. A soft vulcanized strip is used, studded with flat headed rivets, driven from the inside and clinched on and against the outside of the yielding fabric of the tread.

LOOMIS GASOLINE AUTOMOBILE.

These rivets then form hard biting heads, level with or just inside the normal bearing surface of the tread. In this way the rubber in the tread comes in full contact with the road, while, on account of the weight of the machine, the rivets also take hold and make a durable bearing surface, and are said to prevent slipping on any kind of road or pavement.

These treads can be securely cemented to any tire, and are so put on that they cover the bottom and side bearing surfaces. It can also be placed around an inner tube and laced on the inside, or the rivet heads may be placed on the outer tube of a double tube tire. The rivets are double headed and clinched on the outside, to prevent their moving about in the fabric.

The First Club Run.

The first run of the Automobile Club took place last Saturday under weather conditions which were sufficiently unfavorable to test the enthusiasm of the participants. A raw, cold wind was blowing. Ten carriages and a De Dion motor cycle started from the Waldorf-Astoria—five Wintons, three locomobiles and two electrics, one of the latter it was said, being the one which Messrs. Maxim and Entz claim to have run 100 miles on one charge near Philadelphia. The Wintons made the journey in good style; only one locomobile came through, the others being put out by the freezing of valves and other causes, and the two electrics disappeared soon after the start. The destination of the party was the summer house of the club at Tarrytown, where a generous lunch was served by John Brisben Walker, after which the return was made to the city without incident.

Route of Gordon Bennett Race.

The itinerary for the International Automobile Cup, to be raced for on June 14, has been decided upon. The route chosen is from Paris to Lyons, by way of Etampes, Pithiviers, Montargis, Nevers, Moulins, La Palisse, Roanne, Villefranche and Lyons. The road as far as La Palisse is excellent; but beyond that point becomes hilly, and slightly mountainous after Roanne, when the Beoujolais and Lyons heights have to be crossed.

The distance is about 560 kilometers (350 miles). The start will probably take place at Versailles early in the morning.

LONDON NOTES.

London, Jan. 18.

THE AUTOMOBILE CLUB'S 1000 MILE TRIAL.

The arrangements for the forthcoming 1,000-mile trial under the auspices of the Automobile Club of Great Britain are proceeding apace. It is now proposed, if sufficient entries are received, to institute a new category in the trial, viz., that of public automobiles, to carry at least six persons. If the category is established, a special prize will be offered for the vehicle having the best record.

TESTS OF MOTORS.

A series of tests of motors is shortly to be undertaken by the Automobile Club. The move is undoubtedly in the right direction, as between the actual horse-power developed and that at which the motor is rated by the builders there is no doubt some discrepancy. The example set by the French paper, La Locomotion Automobile, in inaugurating a series of motor tests, has apparently induced the Automobile Club of Great Britain to follow the example.

TRAINING THE HORSE.

There can be no doubt that the Automobile Club is becoming a most useful institution. One of its latest departures is to appoint a day on which horses may be brought to their meets, as well as motor vehicles, thus affording opportunities of accustoming the noble animal to the automobile. Another example for the Automobile Club of America to follow.

MOTOR COAL TRANSPORTS.

Most of the central electric light stations in England are so located that the necessary coal is brought right to the spot either by rail or by canal. This is, however, not the case with the several central stations, in the German capital, of the Berliner Electricitäts-Werke Gesellschaft, which has to transport the coal by horse vehicles from the depots to the power stations. Keeping pace with the new means of locomotion, the company now proposes to carry out some trials with motor wagons for the purpose named, and invites builders of suitable vehicles to communicate with them. The address of the company is 35 Luisenstrasse, Berlin, N. W.

THE SIMMS GASOLINE MOTOR.

The Motor Carriage Supply Co., Ltd., of Donington House, Norfolk St., London, W. C., are now bringing Simms' gasoline motor actively before the notice of motor vehicle makers in this country. The engine, which is made in both horizontal and vertical forms, is provided with fins to the cylinder walls for cooling purposes. The ignition is electrical, the spark being formed by means of the Simms-Bosch magneto-electric device, which is now fitted with a timing gear. The engine is guaranteed to develop 2¾-b.h.p.

THE NEXT LIVERPOOL HEAVY MOTOR TRIALS.

At a meeting this week of the Liverpool Self-Propelled Traffic Association, it was decided to postpone the next heavy motor vehicle trials, which were to have been held in October, until May, 1901. The association contemplates organizing meets of light motor vehicles in May and June next, in the neighborhood of Liverpool.

AN ENGLISH AUTOMOBILE RACE IN FRANCE.

The Automobile Club of Great Britain is organizing a motor carriage race, to take place in July next. As road racing is not permitted in England, it is proposed that the contest shall be run off on the roads in the north of France, finishing up in Paris. Strange as it may seem, that the British Club should hold its race in France, it is doubtless a wise decision, as road

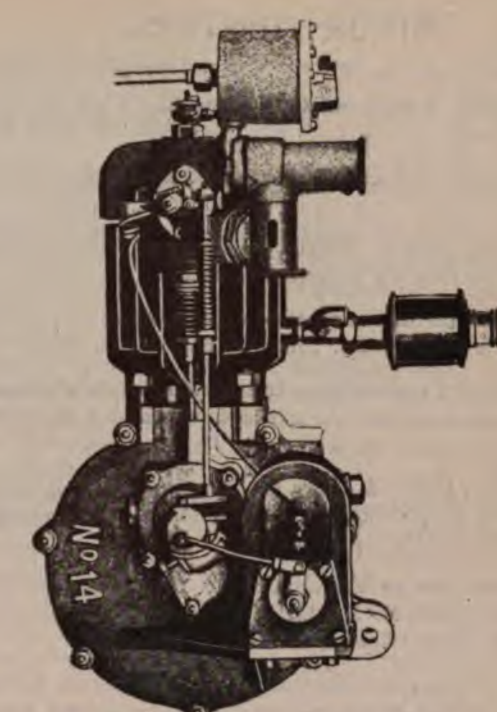
races of any kind have long been out of favor in England, and if persisted in by automobilists, much injury would be done to the new movement.

THE WAR OFFICE AND AUTOMOBILES.

The dilatoriness of the British War Office with regard to the adoption or at least trial of automobiles in connection with military operations has lately been the subject of much comment. The news has, however, leaked out this week that the builders of heavy steam wagons—not traction engines, of which a large number are in use in South Africa—are to bid for the supply of five such vehicles, to be capable of hauling a load of 2 tons at a speed of 5 miles an hour. The result of the tendering is not yet known, but it is doubtful if the vehicles, if ordered, can be delivered in time for service in South Africa, unless the struggle should be more protracted than anticipated. While speaking of the war, it may be of interest to mention that the Motor Mfg. Co., of Coventry, has just shipped three motor tricycles to South Africa, ordered, not by the War Office, but privately by military officers, to be used for dispatch riding purposes.

DAIMLER MOTOR WITH ELECTRIC IGNITION.

Hitherto Daimler motors have generally been fitted with incandescent tube ignition, but a good deal of trouble has here and there been experienced by automobilists, owing to the extinguishment of the lamp or burners, causing annoying stoppages. The result is that quite a number of attempts have been made to apply electric ignition to these engines in place of the incandescent tube, and of one system that has lately been brought out I am able to send you particulars herewith. Fig. 1 shows the position of the sparking plugs B above the exhaust valve on the explosion chamber. Fig. 2 shows the circuit breaker near the lubricator. Fig. 3 illustrates the device for advancing or retarding the period of sparking, carried on



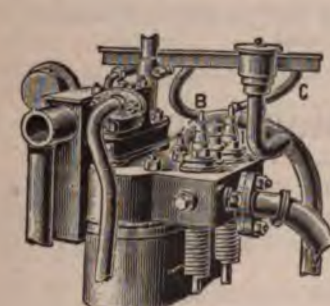


FIG. 1.

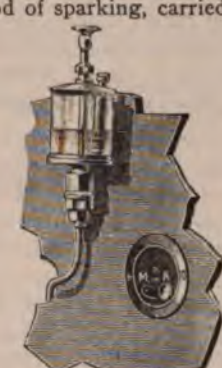


FIG. 2.

FIG. 3.

FIG. 4.

the cam shaft near the starting handle, while Fig. 4 gives the details of the same. One of the wires from the accumulators is connected up to the induction coil, while the other runs to the switch, which is placed in front of the driver. The two wires from the induction coil, which is a double one, are connected up to the timing device. This comprises two touch pieces, G (Fig. 4), of hardened steel, carried on springs and bearing on a fiber ring, H, the circumference of which is surrounded by a phosphor-bronze ring. This latter ring is broken at two points, and the section thus insulated is placed in contact with the mass of the motor by means of a screw, which, passing through the fiber ring, bears on the cam shaft. The new ignition device, which is due to M. Monnier, is being introduced by La Societé Commerciale d'Automobile, 77 bis, Avenue de la Grande Armée, Paris.

Renold, of Manchester, whose reputation as a maker of cycle chains is second to none, is about to bring out a new series of roller chain for motor vehicles. The first size, a chain of 1½-in. pitch, will be ready for the market early in February, and will be quickly followed by chains of ¾-in., 1-in. and 1¼-in. pitch. Mr. Renold has been engaged on the preparation of these chains for the past 18 months, and it is only after long experiments that he has succeeded in obtaining a quality of steel which will give the two necessaries—lightness and durability. The chain will have hardened rivets, bushes and rollers, the last two parts being turned out of solid stock.

A motor omnibus service has just been started between King's Lynn and the suburb of Gaywood. The journey occupies 27 minutes, the fare for the whole distance being only 4 cents. It is also proposed to start a similar service between Rosehearty and Fraserburgh, N. P.

On the evening of Feb. 14 the Hon. J. Scott-Montagu, M. P., will deliver a paper on "General Aspects of British Automobile Manufacture" before the Automobile Club.

A receiver has just been appointed by the debenture holders in the Beeston Motor Co., Ltd., of Coventry.

MINOR MENTION.

A. L. Dow, Longmont, Cal., is building a gasoline automobile.

F. S. Jacks, Napa, Cal., has completed his gasoline carriage.

Postmaster John A. Merritt, Washington, D. C., is testing an automobile for the collection of mails.

New York parties are reported experimenting on motor vehicles at the Mannesmann Tube Works, Zylonite, Mass.

It is reported that the Hygienic Ice Co., recently organized at New Haven, Conn., will introduce motors for the delivery of its ice.

The Stuart Power & Motor Co., capital $100,000, is a recent New Jersey corporation. J. H. Whitten, W. Depuy and H. J. Schutte are the incorporators.

The Shaw Motor Vehicle Co. has been organized under Maine laws by C. M. Martin, H. F. Shaw and W. G. Nixon, of Boston, Mass. The capital stock is $5,000,000.

Perry Okey, a young electrician, of Columbus, O., has completed a gasoline automobile, on which he has been engaged for five years. The carriage weighs 550 lbs.

Louis Langan, formerly of the St. Louis Gasoline Motor Co., St. Louis, Mo., has located at Buffalo, N. Y., where he is organizing the Buffalo Gasoline Motor Co.

The American Cycle Co., Warsaw, Poland, would like to secure the Russian agency for some American manufacturer of gasoline motors and motor vehicle parts. They report a great demand for ¾-h.p. motors to propel bicycles.

The Lunkenheimer Co., Cincinnati, O., recommend that only small quantities of graphite be used with their "Velox" Sight Feed Lubricator for gas and gasoline engines in order to protect the igniters from injury.

A new Maine corporation is the International Automobile Construction Co., capital $100,000. The incorporators are R. M. Gray, W. H. Ricker and C. E. Fay, of Cambridge, Mass., and H. L. Cram, of Portland, Me.

The Non-Polarizing Dry Battery Co., manufacturers of the "O. K." dry batteries, have received from the War Department an indorsement of their cells stating that their batteries had been adopted by the Department as the standard dry cell.

Parry Bros., the well-known buggy manufacturers, of Indianapolis, Ind., are reported about to erect a $500,000 plant for the manufacture of automobiles. They have been experimenting on a gasoline machine since 1892, and now believe they have it perfected.

The American Vehicle Co., of New York, capital $1,000,000, has been incorporated to introduce compressed air vehicles. The incorporators are J. Acken, Nyack, N. Y.; E. F. Slocum, R. B. Hungerford and A. H. Cooke, of New York, and J. D. Campbell, of Scranton, Pa.

H. V. A. Parsell and Arthur J. Weed, of Parsell & Weed, New York, are soon to publish a work on "Gas Engine Construction." Gardner D. Hiscox, author of a work on "The Gas Engine" from an American point of view, is engaged on a new work, to be called "Horseless Vehicles, Automobiles and Motor Cycles."

The Western Automobile Co., of Chicago, Ill., is negotiating for the old Wisconsin Central shops at Stevens Point, Wis. The company, which is capitalized at $6,000,000 under the laws of New Jersey, wants the citizens to subscribe for $200,000 worth of stock at 50 cents on the dollar, and also assist in securing control of the shops.

The Steel Ball Co., of Chicago, is now turning out balls for motor carriages. This firm has just moved into its new factory at the junction of Austin and Claremont Aves. The new plant is 120 x 120 and is equipped with every modern facility for turning out quickly, finely finished steel balls, ranging in size from ⅜ in. to 4 in. They are running day and night, not even letting up at the noon hour.

The Illinois Electric Vehicle Transportation Co.'s stockholders will soon be asked to vote on a suggestion to reduce the capital stock from $25,000,000 to $2,500,000. There has now been paid in one instalment of $5 a share. It is the plan to call for one more instalment of $5, which would make the $2,500,000 of capital. But it is proposed to ask for this second instalment in smaller amounts, from $1 to $2 per share, as funds are needed.

A subscriber in Bellefontaine, O., writes that the International Automobile Co., of New York, is establishing county agencies in that town and in Bellaire, O., selling to its agents 10 shares of the company's stock in return for the exclusive right to the sale of its goods in the county. The company, which claims to manufacture steam and gasoline vehicles, besides representing Benz & Co., of Mannheim, Germany, and Darracq & Cie, of Suresnes, France, promises to deliver its first gasoline carriage about April 1.

THE AUTOMOBILE CLUB.

The library committee of the club has arranged for the following lectures upon the dates named, at 8:30 p. m., at the club rooms. They are to be illustrated by lantern slides, and will be of exceptional interest:

"The Gas Engine as Applied to Automobiles, by A. Fischer, Jan. 27.

"Electric Automobiles," by A. L. Riker, Feb. 10.

"Steam Automobiles," by J. A. Kingman, Feb. 17.

The good roads' committee of the club has arranged for a good roads' meeting on Feb. 3, at 8;30 p. m., at the club rooms, to urge upon the Legislature of New York State the importance of appropriating $1,000,000 under the Higbee-Armstrong bill for improving the highways of the State, at which addresses will be delivered by Gen. Roy Stone, E. G. Harrison, of the Office of Road Inquiry of the Department of Agriculture at Washington, D. C.; Edward A. Bond, Chief Engineer of the State of New York, and it is hoped by the good roads' commissioners of New Jersey and Massachusetts.

At a meeting of the club on Monday evening, Jan. 29, it was definitely decided to hold an automobile exhibition next October under the club's auspices, probably at Madison Square Garden.

Compressed Air Versus Steam for Motor Vehicles.

By Henry F. Bryant, C. E.

Over a year ago the writer put together a few ideas regarding the comparative merits of steam and air as a motive power for vehicles. Pressure of business caused the paper to be neglected and to lie uncorrected on his desk.

Since it was written the steam carriage mentioned has been driven several thousand miles, with the result that the previous statements are confirmed, with the exception that a slightly increased cost for fuel has been manifest, although not to an extent to modify the conclusions drawn.

The comparison is made entirely on theoretical lines with a full understanding that a consideration of the shop details would simply add weight to the statements made.

So far as apparent developments go, the air vehicle is not a success to an extent to warrent its being sold or used, and the stock market is relieved accordingly.

The periodical literature of to-day, and especially the daily press, abounds with articles, editorials and notices regarding the forthcoming application of compressed air to motor vehicles.

It may be that the original statements were inspired by various corporation promoters, but it is certain that the greater part of what is seen in print is volunteer information or opinions from inconsiderate parties. It has been stated that it is the purpose of various new corporate bodies to acquire control of a large portion of the trucking business of some of our large cities and to conduct the work by means of compressed air trucks.

This arrangement, covering 'bus lines, cab companies, livery stables and the like, has been the foundation for a large number of requests for franchises all over the country.

Four or five years ago the technical press had much to say about the merits of compressed air, and the writer in consequence has always been an advocate of its use where such use is reasonably economical, and was prepared to believe that air vehicles were feasible.

Some time ago, while discussing the merits of a steam carriage which was on the market, and one of which the writer has purchased, the astonishing statement was made that the weight of the necessary water on a steam carriage was no more than the weight of the necessary air alone for an air carriage. This statement led to an investigation of the facts so far as they could be obtained, with the results given below.

Let us first consider a type of light pleasure carriage for two persons and later take up the opposite extreme, as exemplified by heavy trucks, etc.

To be specific, and therefore, perhaps, convincing, we will take the steam carriage with which the writer is familiar, as it is in every way a successful light pleasure carriage and has been in operation for some time. With respect to a light air carriage of a similar type, there seems to be no experimental data directly applicable, possibly because of difficulties to be mentioned later, so that we must compare our actual light steam carriage with a hypothetical light air carriage, and later we will compare an actual heavy air truck with a hypothetical heavy steam truck.

The figures for the steam vehicle are as follows, and are conservative, as they are actually bettered in practice:

Weight of carriage alone	225 lbs.
Entire power plant (motor 35 lbs.)	150 lbs.
Water 125 lbs. and fuel 15 lbs.	140 lbs.
Weight complete for 50-mile run	515 lbs.

One gal. of gasoline evaporates 62½lbs. of water; 2½ lbs. of water used per mile run in average country. Steam pressure, 160 lbs. on the gauge. Speed, variable from 0 to 25 miles per hour.

These figures give us an evaporation of 73 lbs. at atmospheric pressure for each gallon of fuel which makes the cost about 1c. per 10 lbs. of water evaporated. This is as economical a figure as is ordinarily found in small commercial plants, but is only about one-fourth as good as the results from the best air compressing plants.

Now, with the steam system the vapor is used directly in the motor without any serious losses, while the air system requires the intervention of a compressor engine, a receiver and a reheating furnace before the power reaches the motor piston.

Such a roundabout method would at first sight indicate losses all along the cycle of changes, but it is well known that by proper reheating a full 100 per cent. of the steam power used can be applied to stationary motors by means of compressed air, while a moving system would undoubtedly show an efficiency of 80 per cent. at least.

There are losses, however, which actually occur; for instance, that loss which comes from the difficulty of cooling the air in the compressor cylinder with sufficient rapidity to bring its compression curve to the isothermal line, and besides, the whole heat of compression is usually lost. This loss, plus engine friction, is not far from 20 per cent. of the applied power. The losses in transmission to the receiver and thence to the storage tanks on the vehicle are small and can be neglected, as can be the losses due to the reduction from tank pressure to working pressure by the reducing valve.

Such losses as actually occur are made good at no great expense by heating the air just before it passes to the motor, and this reheating also serves the purpose of preventing the clogging of exhaust passages by frost.

We therefore have our air obtained under the most favorable conditions, from stationary high duty engines, with all possible opportunities for cheap fuel and heat economies.

Now, when the air is properly warmed, there is but little choice between it and steam in working the motor piston after its introduction into the cylinder, so that the light carriage which we have already considered will require an amount of 160-lb. air equal to the amount of 160-lb. steam furnished it.

As given previously, the motor requires 125 lbs., or 2 cu. ft., of water in running 50 miles, which is equivalent to 328 cu. ft. of 160-lb. air or steam. Now, 160 lbs. gauge is practically 12 atmospheres, so that 12 times this amount will give the amount of free air required to do the work, or 3,936 cu. ft.

The everyday idea is that air has no appreciable weight, especially when surrounded by the atmosphere under normal conditions. As a fact, 1 cu. ft. of air at atmospheric pressure and 60 deg. F., weighs .0768 lbs., and if it be compressed to one-fourth its original volume or to any other reasonable extent, its weight will remain the same.

Suppose we compress this air of ours to 150 atmospheres, or 2,205 lbs. per square inch, obtaining a volume of 26.2 cu. ft. as the space or storage required for it in storage tanks on the vehicle. Now, to maintain a minimum pressure of 160 lbs. to the end of the run, we must have 314 cu. ft. of free air in the

tanks at the finish, making the original amount required 4,250 cu. ft., with an initial pressure of 2,380 lbs., instead of 2,205 lbs., and giving the surprisingly large weight of air as 326 lbs.

Putting this into 13½ x 30 in. cylinders, ½ in. thick and of a capacity of 2.5 cu. ft., we get a stress of 32,000 lbs. per square inch as a working pressure on the steel, which seems quite enough. The weight of the tube would be 87 lbs. per cubic foot capacity, but as tubes weighing 66 lbs. per cubic foot capacity have been used without accident, we will use the last figure, which will give the weight of our 11 cylinders as 1,730 lbs.

To reheat the air it is common practice to pass it through heated water, evaporating some of the latter, which afterwards assists in the motor by its condensation. Variable amounts of water are used, varying, at least, between ¼ and ¾ lb. of water per pound of air, and the use of ½ lb. of water per pound of air could not be called excessive.

Since we carry 302 lbs. of effective air, we shall require 151 lbs. of water to properly heat that air with sufficient fuel to evaporate it at from 370 to 400 deg. F. The point may be raised here that it is not necessary to actually evaporate this water; but it can be readily demonstrated that to gain the desired advantages from reheating it is necessary to use the same amount of heat that is required to expand the water. Assuming the heater to be as good a one as exists on the steam carriage, the weight of the needed fuel would be 17 lbs., as against the 14 lbs. already mentioned, at a cost of 19 cents against 16 cents.

Let us see now what the minimum weight of our light compressed air carriage would be, ready for a 50-mile run:

Carriage alone, as before	225 lbs.
Motor, 35 lbs.; heater and tanks, 100 lbs.	135 lbs.
Water and fuel as above	167 lbs.
Receivers for 26.2 cu. ft. of compressed air	1,730 lbs.
Air in receivers when first charged	326 lbs.
Total	2,583 lbs.

Now, no carriage weighing 225 lbs. could carry the weights given above, and enough should be added to bring the total to 800 lbs.

Again, the motor we have been considering would not cover 50 miles with the above weight at the desire speed, and should be enlarged to weigh 100 lbs.

Such a carriage and motor would also require more air to operate, which means about 7 cu. ft. capacity more, or 790 lbs. more weight. We therefore have:

Total as above	2,583 lbs.
Increased weight of motor	65 lbs.
Increased weight of carriage	575 lbs.
Increased weight of receivers and air	790 lbs.
Total weight	4,013 lbs.

which makes the air carriage nearly eight times the weight of the steam carriage, notwithstanding that we have made the former as light as possible.

The prime requisites of any successful method of transforming heat into work in an automobile may be given as:

1. Ability to furnish ample power and speed under all conditions.
2. Safety at all times.
3. Economy of operation.
4. Ease of management.
5. Simplicity, lightness and low first cost.
6. Lack of objectionable noises, odors, motions, etc.

The general impression prevails that steam boilers are dangerous except in the hands of experts. This is an idea that the public has obtained from the long-continued practice of using large boilers where riveting is relied upon for strength and where the shell is often strained nearly to its breaking point.

Under such circumstances, accidents are not surprising; but with small generating units, it is easily possible, at no great additional expense, to obtain a strength of over 3,000 lbs. of pressure per square inch, while actually using less than 200 lbs. per square inch. With a device for shutting off the fuel automatically at a given pressure and a safety valve which cannot fail to work, there can be no explosion, for the evaporation of all the water cannot possibly do any more harm than will require a few moments use of a caulking tool to repair.

This has been repeatedly demonstrated by experiment.

It is claimed that the steam carriage is "fool proof" so far, at least, as the "fool" is concerned. Any carriage or machine can be injured by reckless handling.

In the air vehicle, we have in the heater a device corresponding to the boiler of the steam carriage, and it can undoubtedly be made equally safe, while, in addition to this, we have tubes charged with high pressure air, which, as they are not subjected to fluctuating heat, can be considered fairly safe except in case of an accident by collision or the like, which should rupture the cells when under full strain.

The consequences of such breakage would be neither burning, suffocation or scalding, but simply cold, with the possibility of flying pieces of metal, doing some mischief. Such an occurrence would be very rare, and need have but little influence on the use of high pressure air. The writer would personally prefer the boiler to the high tension receiver, and most certainly the boiler is preferable to receiver and heater combined. This matter, however, need cause but little concern in either case.

That superior manageability rests with the lighter carriage hardly needs demonstration, while easy steering may be found in either. The rapidity of starting and stopping are great factors in easy handling in crowded situations, and this cannot be well had in heavy carriages, even with the use of power brakes.

Simplicity and low first cost is more fully approached in the steam vehicle mainly on account of less weight, but partly on account of its lacking the necessity for storage reservoirs and their fittings.

Those who have best observed compressed air as used abroad state that the mechanism for controlling it is much more delicate and liable to get out of order than are similar arrangements for steam control. This would mean less time in shop for repairs in the case of the steam carriage.

The amount of noise, odors and motions would be and need be no larger in the one case than the other; but in one respect, at least, air is superior to steam, and that is as to heat and the visibility of exhaust.

The products of combustion from a steam boiler would be at a higher temperature than that from a reheater, and the exhaust steam would always show in cold weather.

Neither of these matters have been found objectionable, however, as only a small, quickly vanishing stream of vapor is visible beneath and behind the carriage, and there is no difficulty in holding one's hand in comfort over the hot air outlet.

Horses are not frightened any more than by any strange moving object of like size.

Economy of operation we have seen is in favor of steam, since less fuel is used by it in transit than by the air system, while with the latter the cost of compression, distribution and administration of the stored air is added as an extra, and from the figures already given the cost of air can be shown to be twice the cost of steam.

The relative first cost of the vehicles can be only estimated, but the air vehicle will cost nearly three times the steam carriage.

We will summarize our conclusions as we have just found them, as follows:

1. No choice in the matter of ample power.
2. Equal safety from injury to passenger, and greater safety for the mechanism in steam carriages.
3. Economy of operation is in favor of steam in the proportion of at least 1 to 2.
4. Ease of operation or manageability lies with steam.
5. Simplicity, lightness and first cost are all on the side of steam.
6. Ill appearance, objectionable noise, odors and motions exist in neither case, while heat and visible exhaust are found to a greater extent with steam.

For heavy work, which would seem to be the field for air motors, the showing is very much the same, and is still much in favor of steam, judging from known examples.

There are at hand the description of two heavy trucks operated by compressed air. One weighs 8,000 lbs. and has a capacity of 10 tons load for 30 miles on level roads, carrying 50 cu. ft. of air at 135 atmospheres. The other weighs 4,100 lbs., with a capacity of 7 tons, 15 miles, with 24 cu. ft. of air in receivers at 2,000 lbs. and upward per square inch.

The first mentioned example, since it requires the greater power, will be considered as a typical one.

In this truck it will be noted that the air capacity is about double that which was first computed for our hypothetical light carriage, and the pressure is similar.

For the sake of simplicity, we wil assume that these reservoirs furnish just twice the air furnished for the light carriage instead of slightly less.

Neglecting the effects of compounding which, although slightly more useful with air than with steam, would show no great difference between the two, we find that a duplicate or double steam system, similar to the light carriage system, will furnish the required vapor and transform it into power.

From this we can estimate our weights as follows:

Weight of steam power plant	150 × 2.......	300 lbs.
Weight of water	125 × 2.......	250 lbs.
Weight of fuel	14 × 2.......	28 lbs.
Truck body (estimated)	....	1,000 lbs.
Total weight	....	1,578 lbs.

There would also be an increase in endurance due to the lighter weight of the steam wagon, but this we will neglect in making our comparison.

In practice, the two motors would probably be combined for sake of simplicity, but with no resulting increase of weight.

It is apparent also that both forms of air carriage are tied to their compressor plant and can never go far away from it, while the two systems are on equal terms regarding fuel and water which can be found nearly everywhere.

The above conclusions indicate the same relative usefulness of the two systems for heavy work as for light work, and unless some new methods for using air have been perfected and not yet announced, it seems reasonable to state that if air motors obtain any foot hold in transportation matters, it will be because of the existing prejudice against steam or because of ignorance as to the limited possibilities of air or perhaps because of strong financial backing which may be able to withstand the natural development for a time.

It is not by any means certain that the steam motor will prove superior to coming oil or gasoline motors, but so far as the writer has been able to observe, the troublesome odor, noise and motion from the so-called odorless motors prevents their being popular for all around use. The difficulty of starting and of regulating speed is also yet to be satisfactorily overcome.

For the present, then, steam seems to be the most promising field for experiment, especially as electricity is yet waiting for an economical and light storage medium before coming into general use.

We hear wonderful things of liquid air, which we hope may prove to be based on facts; but until some new source of power or improved methods of utilizing known sources, appears, we can best pin our faith on steam, wasteful as it is, for all around service.

The Storage Battery from the Standpoint of the User.

By W. M. Hutchinson, M. D.

At this stage of the development of automobilism, it would seem proper that observations made by users, although not themselves trained engineers nor mechanicians, should be put on record, and by means of journals like The Horseless Age placed before others who are interested, but who have not as yet had experience.

I would say in preface of what I am about to state regarding the storage battery situation as I see it, that I am trying to approach the subject in a perfectly fair and truly scientific spirit, entirely unbiased by any financial or trade interest, and that what I wish to accomplish in this article is to place before the readers of this journal some notions of my own—some ideas that I have formulated, not by reading what others have said, but as a result of 18 months' personal experience with an electrically propelled vehicle—together with a brief explanation of a method that I have adopted in caring for and keeping in order a vehicle battery.

Furthermore, it is but fair to state just at this point that my observations have been limited to the product of one manufacturing concern, but my battery is, I believe, a fair type of the "formed" class, and therefore what I shall have to say will apply to all the modifications of this class of accumulators.

Probably the fact that has been brought out most prominently and has impressed itself most indelibly upon my mind by what I have done along this line is that he who possesses himself of a storage battery to apply to vehicle traction must clearly understand from the very outset that he has acquired a piece of apparatus that will require constant, skilled and intelligent care and attention if it is to be of service to him.

And the manufacturers themselves now say the same thing, although they did not make it so clear a year and a half ago. One, in an article upon this subject, puts it "daily care." Another, in a booklet of information just issued, says "the cells should be carefully examined once a week." My own opinion is that when performing ordinary work, say 15 to 30 miles daily, a battery should be subjected to painstaking inspection every week, assuming that the user has observed reasonably the directions and rules given by the manufacturer.

Now, let us see what this weekly inspection means. First of all, the condition of the elements is to be determined by testing their voltage during and after a discharge that has been going on at the usual discharge rate for at least half an hour. This we call the "voltage on discharge," and is best obtained by discharging the entire battery through sufficient resistance to cause them to give off current at a rate equaling that given when the wagon is at full speed. Then, at the end of, say, 30 minutes, we take readings of the difference of potential between the terminals of each of the four sets of cells, while the current is so passing out.

The importance of this point has not been well brought out—at least not until quite recently—but should be strongly emphasized, viz., that no idea of the condition of a cell nor a set of cells can be obtained by taking the voltage "standing" nor while "on charge." Very frequently a set will be found to be low under this test, and then we proceed to determine which particular cell or cells are in trouble.

Up to this time battery has not been withdrawn from the vehicle, but now, by the aid of two muscular stable hands, the crates are drawn out. Before going further, it is well to remove the vent plug from each cell and ascertain, by ocular inspection, the height of dilute acid within each jar, any that are found in which the fluid has evaporated below the tops of the plates being refilled with very dilute acid.

My experience has been that we will rarely find trouble in more than one set of cells at any one time, and in order that my wagon may not be out of commission while the faulty set is being overhauled, I have provided myself with an extra or spare set, which is now substituted for the one at fault, and thus a complete battery is returned to the vehicle, once more the good offices of the two hostlers being called upon.

Current is now sent in, and in perhaps an hour or so the battery is in shape to drive the wagon again. Of course, the spare set that we have just included in the equipment becomes a little overcharged by this plan, as it was and should be fully charged while waiting to be called upon for substitute duty; but as we do not carry this charge far they will soon equalize—say, after one or two runs.

In the meantime the abnormal set has been taken around the corner to my house upon a hand truck and placed upon a bench in the back kitchen, where I have installed a charging and repair station, much to the disgust of the tidy housemaid who presides over this department, and we proceed to search for the cell or cells that are out of condition.

Inasmuch as this article is not intended to be at all technical, I will not even enumerate the difficulties that we may find, but simply say that the trouble may be within the cell itself or with the outside connections. To determine which cell is at fault we take two brad awls or other sharp instruments, which we have connected with our low reading voltmeter, and thrust their points into the lugs of each successive pair of plates until we come to a cell that reads low, or, as is often the case, reads nothing, this test being also conducted while the cells are undergoing a fairly heavy discharge. The method of performing this test is quite well shown in the photograph that accompanies this article.

STORAGE BATTERY OUTFIT OF DR. W. M. HUTCHINSON.

The cut shows a set of 10 cells within their crate, that again within a sort of hand barrow made from a packing case, the terminals of the set being connected to the switchboard, while a suspected cell is having its voltage determined by means of the awls and a little inexpensive voltmeter upon the shelf in the center. Upon either side are the portable voltmeter and ammeter, both controlled by single-pole switches in such a way that charge or discharge can be given when they are in or out of circuit, in case they are wanted around at the stable.

The double throw switch upon the center of the board puts the set on charge or discharge, according to its position, while a switch below the table cuts in the amount of resistance needed for charge or discharge. This resistance is simply some German silver wire running back and forth in coils below the table, and not shown in the cut.

The material for the entire outfit, including the resistance, but excepting, of course, the portable measuring instruments, cost, I should say, about $3.

For much assistance in designing this board and its connections, and for its entire construction, I am indebted to Mr. Thomas Hall Wyatt, a student of medicine in my office.

Having by this device discovered the weak cell, with a hack saw we open its connections, remove the plates, have them and the containing jar washed out, and then return them, always replacing the positive plates with a new pair, keeping the negatives in the meantime under water, that they may not air discharge. The jar is now closed up, returned to the crate and the connections soldered up with a blowpipe flame, the gas tubing for which is shown in the cut.

It is quite possible that I discard positives at times that are not entirely exhausted and that would do considerable more work if the jar were simply washed out, but I am not sufficiently expert as yet to determine the condition of a positive plate by its appearance.

Up to this writing I have not had the above described method in operation long enough to have obtained any reliable data as to the number of plates that need renewal monthly, but should approximate battery deterioration as amounting to, say, $40 or $50 annually, for a 40-cell, 5-plate battery, not counting the labor required.

I would not have it understood that I am obliged to make weekly renewals form the very first, as a new battery may do constant daily work for from three to six months, perhaps, without requiring anything but the weekly addition of some dilute sulphuric acid. This question seems to be an uncertain one—just what the average life of a plate is—even from the same maker, some being much more durable than others.

If the reader has been patient enough to follow me thus far, I take it he will agree with me that the storage battery of to-day is an exceedingly troublesome comfort to place into the hands of the everyday sort of man who wishes a vehicle which shall be one of the tools of his trade, and that it can never come into general use except it shall come to pass that a number of users in a community support a charging station, with shop equipment and mechanics, as well as coach house facilities. I am sorry to speak thus disparagingly of the electric vehicle, for it is a delight to operate, and, outside of the battery, but little trouble to maintain; and speak as I do only after carefully weighing my words. How my troubles will compare with my present ones after I have operated a gasoline or steam vehicle, as I hope to do, I cannot say. This much I know: Absolutely no reliance can be placed by any intending purchasers upon the statements of any manufacturer, because of the different requirements and circumstances of purchasers.

Of course I am not now referring to the pleasure vehicle, but know of no way for any one contemplating purchasing an automobile for professional or light business purposes, but for him to make the most wise and careful selection he can, as to motive power and maker, and then determine after six months or a year whether or not it has adapted itself well to his individual requirements.

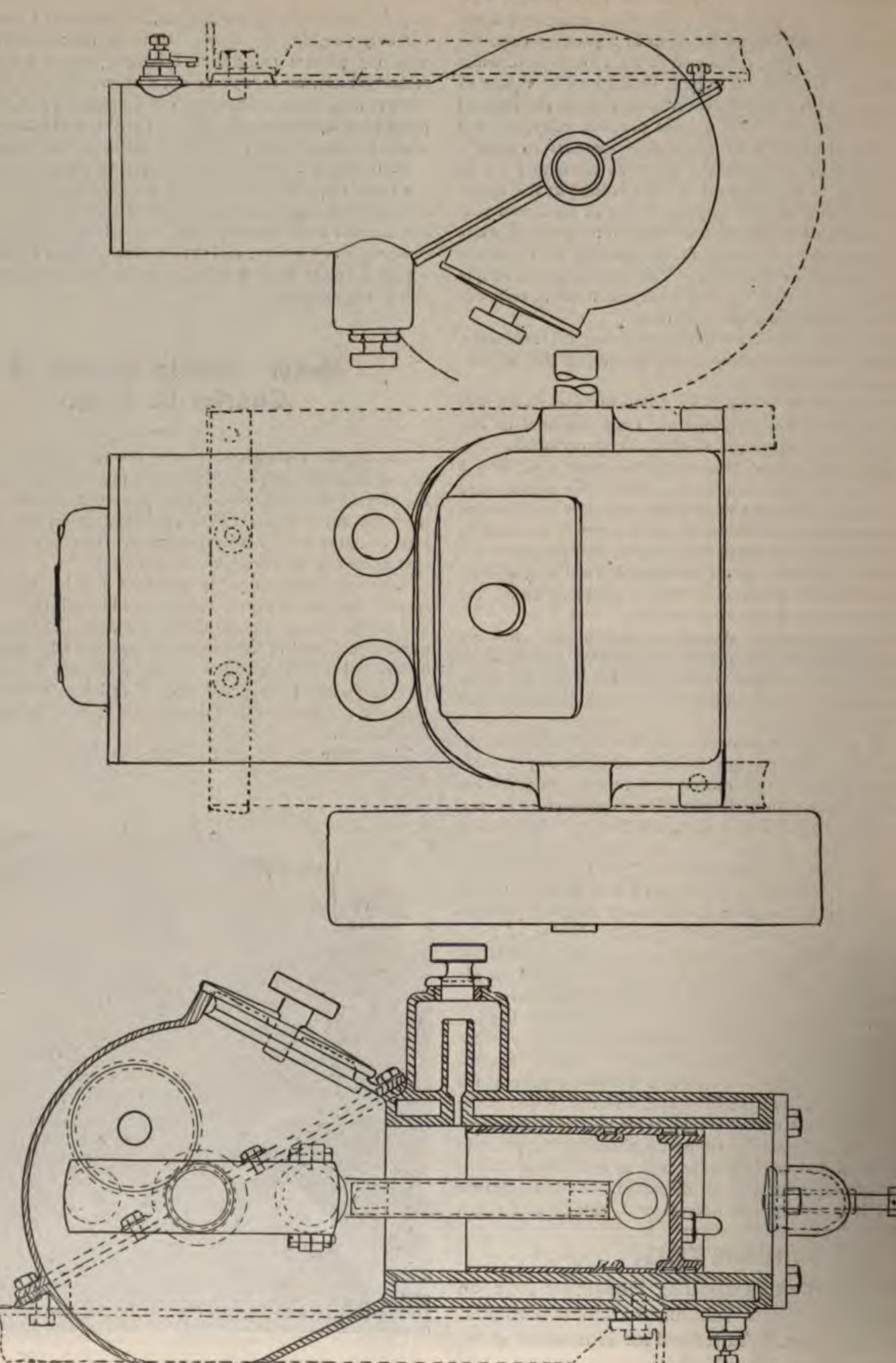
Motor Vehicle Engine of Charles B. King.

The engine represented in the accompanying drawings is one of the simplest yet designed for this service. It has been the aim of the builder to carefully protect all working parts from the dirt and sand of the road, and the crank case therefore contains all the working parts. The large door gives easy access to the crank case at any time.

Automatic lubrication is provided for by means of the special cups placed on the cylinders, which oil the cylinders as well as the cranks through the hollow rods. The cups entirely obviate the smell of burning oil on the road by their uniform delivery of oil. This engine weighs about 250 lbs., makes 500 revolutions per minute and develops 4 b.h.p., with two cylinders 4 in. in diameter by 6-in. stroke. The fly wheel is 17 in. in diameter.

The engine was designed by Chas. B. King, of the Chas. B. King Co., Detroit, Mich.

PHŒNIX GASOLINE DELIVERY WAGON.



PLAN AND ELEVATION OF VEHICLE MOTOR OF CHAS. B. KING.

OUR FOREIGN EXCHANGES.

The Voiturette Renault Freres.

There is a possibility of contenting one's self with a relatively weak motor by reducing, for example, the transmission mechanism to their simplest form, avoiding all useless friction, and, consequently, all loss of force.

This is the case of the Renault carriage, which has neither chains nor belts, and in which the gearing is made by two sets of gears only for the fast or slow speeds, as we shall proceed to explain.

The shape of the carriage is that of a buggy without top; it is hung by four clamped springs on a tubular frame, which receives the motor, the three speeds and the backing motion, the whole controlled by a progressive friction clutch.

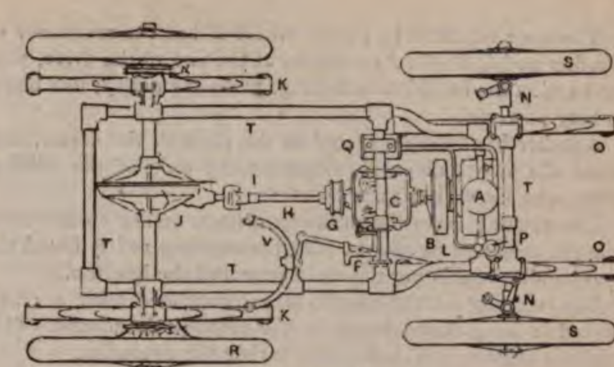
The motor, held at A (Fig. 1), is a simple De Dion-Bouton of 1¾-h.p., with flanges. Placed in front in the semi-circular box represented in the photograph, it is under the best conditions for cooling. The carbureter is on the Longueware system.

The motor communicates its motion by the friction clutch B to a shaft, which crosses the box, with the speed gears, and by the shaft H and the universal joint to a bevel gear meshed into a crown gear outside the differential J, whence the motion goes directly to the driving wheels R R at the rear.

The most interesting feature is in the very great simplicity of this transmission. In the fast speed friction is avoided, for the force is sent directly from the clutch B (Fig. 2) to the axle M. N, and by the extension H (Fig. 3) to the bevel gear G, meshing to the differential. The shaft H is supplied with two Cardan joints (universal coupling), as at I, loosely fastened so as to permit the oscillations of the springs. It will be seen that under these conditions (fast speed) the speed changing gears do not interlock, there is but a single transmission shaft, and the carriage is found sensibly under the same conditions as a motor cycle.

In the speed gearing case, shown in Fig. 2, a shaft, M, in one piece with the cone F of the friction clutch B, carries a pinion, I, which can be moved along the shaft M, carrying a claw clutch, E, permitting the pinions 7 and 8 to be either in-

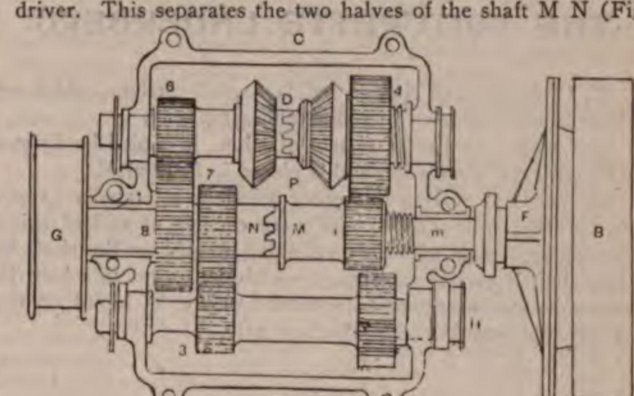
RENAULT GASOLINE CARRIAGE.



FRAME OF RENAULT CARRIAGE.

dependent or solid in such a way that, in the position in Fig. 2, the movement is transmitted directly to the longitudinal shaft of the carriage.

To obtain the medium speed it is sufficient to turn from left to right the controller v (Fig. 3), placed at the left of the driver. This separates the two halves of the shaft M N (Fig.

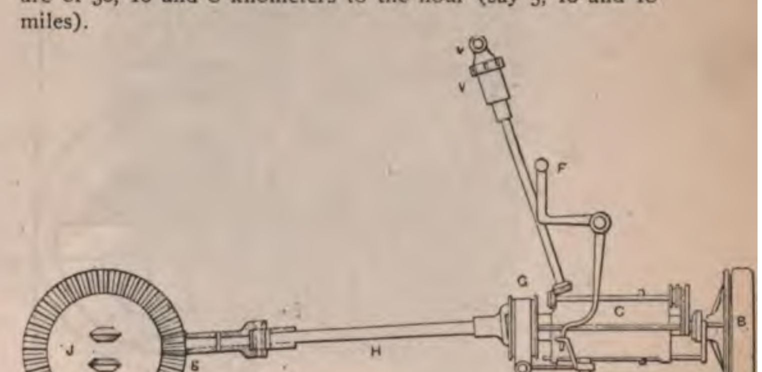


TRANSMISSION AND SPEED DEVICE.

2) and turns the eccentric shaft H around its axis; consequently the pinions 2 and 3, fixed on the shaft H, gear with the corresponding pinions 1 and 7, giving the demultiplication desired.

If the controller is turned in the opposite way the eccentric shaft I will be turned, instead of H, the motion then passing from 1 to 7 by way of the pinions 4 and 6, thus giving a still slower speed.

For obtaining the backing motion it is necessary to interlock a bevel gear with the two gears P on the shaft I; this bevel gear is put in place with a special pedal. The speeds are of 30, 16 and 8 kilometers to the hour (say 5, 10 and 18 miles).



TRANSMISSION AND CONTROL.

The cone clutch F in the fly wheel B has the assistance of another pedal, F (Fig. 3), which, at the end of the drive, puts into action the band brake G (Fig. 3) on the pulley; this brake is very powerful.

Another hand brake, placed at the right of the driver, acts upon the two pulleys X, fixed on the axle of the driving wheels, as shown in Fig. 1.

The starting is on the ordinary system, acting on the front wheels, mounted on pivots. On the steering rod is found the two handles regulating the carbureter and the ignition.

The starting of the motor is accomplished with a crank placed in front of the driver on the carriage dashboard. This will not require one to step out during the operation.

The dimensions over all are not more than 1.80 meters by 1.02 meters, and the weight about 200 kilograms (440 lbs.). Ball bearings are applied and the gears turn in an oil bath.—La Locomotion Automobile.

THE VOITURETTE UNDERBERG.

M. Underberg, of Nantes, builds a small carriage, which we show in the half-tone, of remarkable simplicity.

The motor, Gaillardet system of 3-h.p., is cooled by flanges without water circulation and is placed in front at M.

By means of gearing the motor drives an intermediate shaft, A, carrying four wheels, which are capable at will of being thrown into gear with corresponding wheels on the shaft B. This shaft B carries a pulley, p, which, by means of a belt, E, transmits its movement to a second pulley, P, keyed on the differential gear borne by the rear axle.

The motor is put in motion by means of a crank, fixed in front of the carriage, which is disconnected automatically as soon as the motor starts. Then the driver mounts the vehicle, and manipulating the lever L, placed to his right, he obtains a pull on the belt by slightly moving the rear axle. The changes in speed are controlled by the lever C, moving a frame along the shaft A, carrying the gears. We have seen how the four speeds are obtained.

The carbureter C has a constant level and is automatic. It is fed by the tank R, placed in the back of the seat. When there is need for heat the tank is supplied by a branch pipe from the exhaust of the motor. A double valve, controlled by handles fixed on the upright steering tube, permits of adjusting the mixture of air and the spirit vapor for introduction into the cylinder.

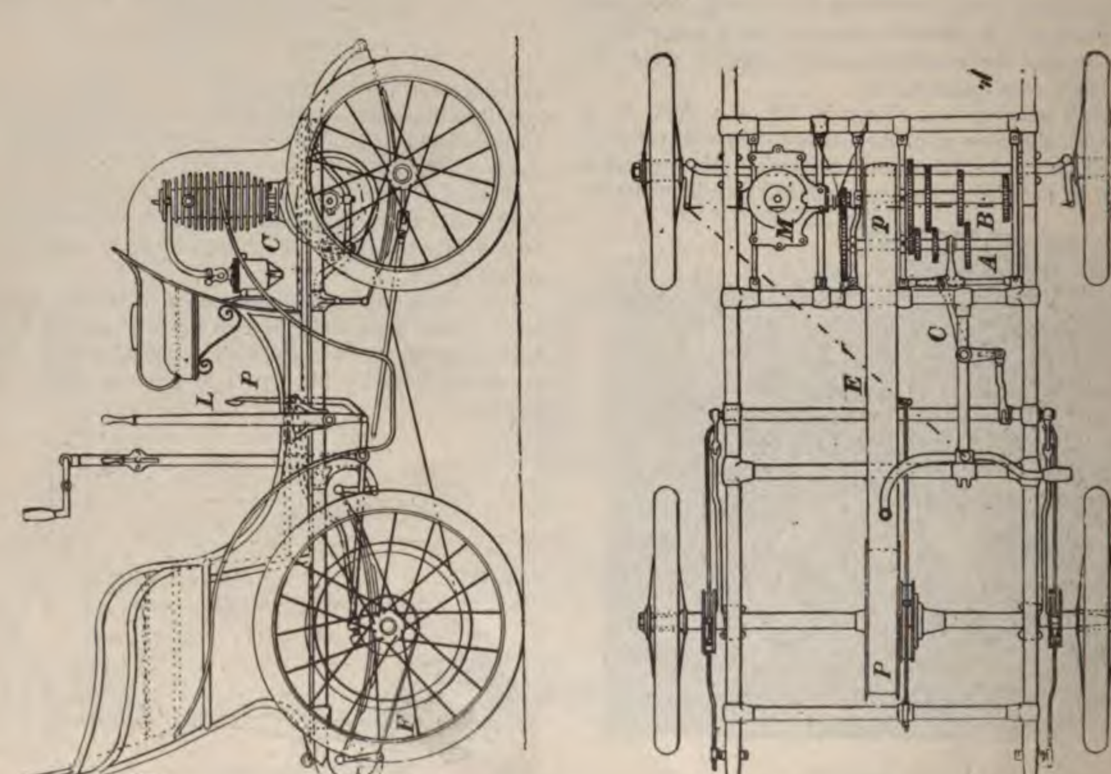
The ignition is occasioned by an induction spark and a handle on the steering lever allows of varying the point of ignition of the gaseous mixture.

In any case where, for one reason or another, the source of electrical energy shall be drained, a platinum tube placed in the head of the motor and heated by a Longuemar burner takes the place of the electrical ignition.

The carriage represented in the figures will seat two, but a seat bracket placed in front will accommodate a third passenger or a valise. Under test this little carriage has given an average speed of 25 kilometers (15½ miles) to the hour, and on the slow speed it will climb an 8 per cent. grade.

The frame is built of steel tubing, without solder, of 40 millimeters (1.58 in.) in diameter, and is suspended on springs.

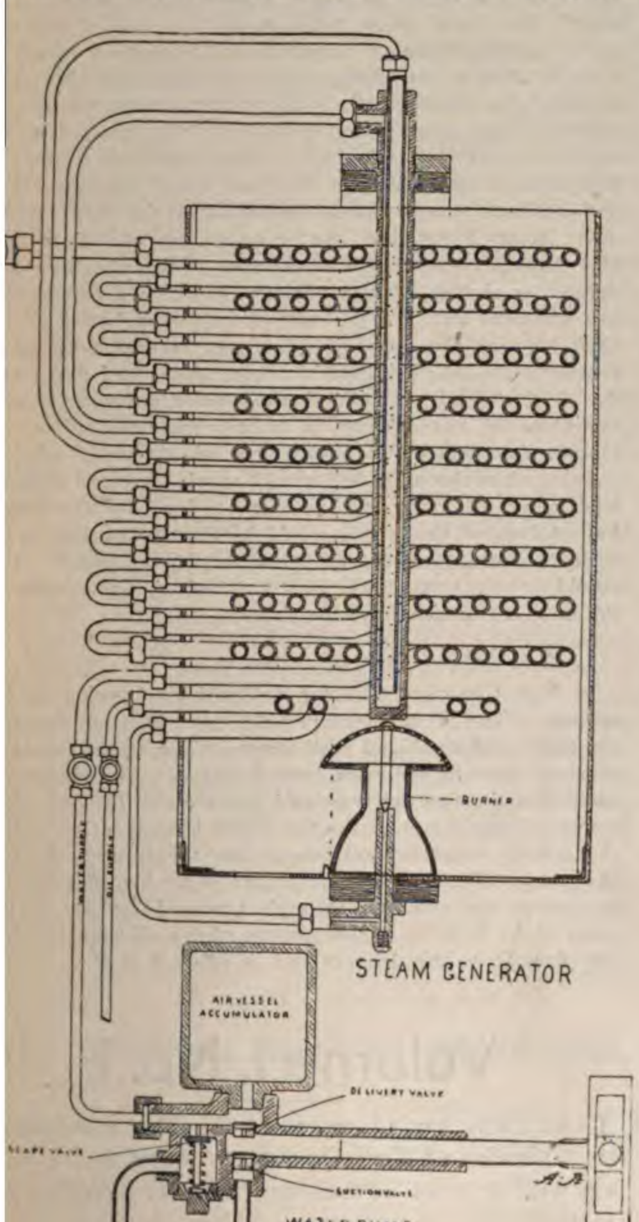
The wheels have pneumatic tires of 65 millimeters (2.56 in.), and have ball bearings. Weight of carriage in running order 280 kilograms (616 lbs.).—R. Denham in La Locomotion Automobile.



ELEVATION AND PLAN OF UNDERBERG CARRIAGE.

The Blaxton Steam Generator.

The Blaxton Engineering Co., of 69 Old St., London, E. C., re manufacturing a steam generator for motor vehicles which resents several features of interest and novelty. The generator is of the "flashing" type, and consists of a number of coils f steel tubing, 1 in. internal diameter. Each coil forms a separate element, and has about 10 sq. ft. of heating surface. These coils are superposed, as seen in the illustration, and are oined up in the series by means of nuts and unions placed outide the casing, and away from the heat of the furnace. This enerator is fired by liquid fuel, and its principal feature is the neans employed for automatically adjusting the consumption of fuel in the same ratio as the consumption of steam. The urner is of the ordinary vaporizing type; the liquid fuel is orced under air pressure through a heating coil, where it is vaporized to the burner, the vapor passing through a needle valve, as shown, and issuing through the perforations in the cap. This cap is capable of a slight vertical motion, and to it is attached the spindle or stem of the needle valve. This cap seats on a perforated flat plate, through the perforations of which is induced the air necessary for combustion. Rigidly fixed in the vertical axis of the generator is a large tube, closed at its lower end, which just touches, or nearly so, the cap of the burner, and connected at its upper end to one of the elements. Within this tube is another, open at its lower end, and also connected to an element. There is thus a path provided for the continuous circulation of the steam or water. The function of this central tube is to regulate the amount of vapor passing through the needle valve, by its varying length, due to expansion and contraction. The action is as follows:



On lighting the burner the temperature of the elements is raised to any desired degree, sufficient to vaporize the feed water. If there is a constant supply of cold feed, the central tube remains at a temperature, and consequently has a length sufficient to allow the needle valve to pass sufficient oil gas necessary to evaporate the water. If the feed is diminished the water is consequently evaporated, and the temperature of the central tube raised; this causes an increase in its length, and hence the lower end, pressing upon the cap of the needle valve, tends to close the latter.

The feed water is at first pumped by hand into an air vessel, and is afterwards maintained at any desired pressure by the pump, as shown. When the elements have been raised to the necessary temperature the feed flows into the coils, and is at once flashed into steam, which is led through the main stop valve to the motor. As the steam is used more cold feed flows in, and the central tube remains at a temperature, and therefore of a length sufficient to allow the combustion of the oil gas necessary for combustion. A greater demand for steam augments the action until it reaches the maximum, which is regulated by the diameter of the orifices, and a cessation of the demand stops the entrance of water, and allows the tube to expand and close down the flame. When the steam valve is closed down, if there is any excess of water in the tubes above what is necessary to maintain the pressure, it is forced back through a loaded relief valve into the reservoir from which it was pumped.

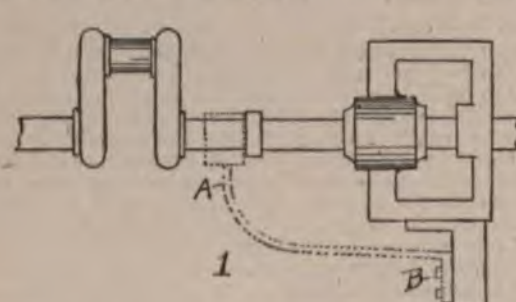
The generator illustrated is 5 ft. 9 in. by 3 ft. by 3 ft. It has 126 sq. ft. of heating surface, the normal pressure of steam is 200 lbs. per square inch, and it will generate steam sufficient for a 25-h.p. motor. Its weight, including casing and fittings, is about 1,400 lbs. —The Automotor.

FIFTH AVENUE LEAD BUS.

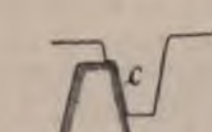
Motor Vehicle Engineering.

TOO MUCH SPRING ON THE SHAFT.

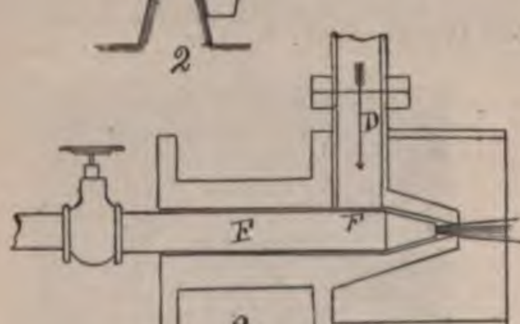
Steadiness of motion is one of the essential requirements of the mechanism of a motor vehicle. In one motor the bearings of the shaft on which was the driving mechanism, were very poorly fitted, as shown in Fig. 1. The downward pull of the crank caused most of the weight of the shaft to fall upon the inner bearing, and as the shaft sprung at each turn, this bearing was continually giving trouble and weakening the gearing. This defect was rectified by putting on a new bearing at A, maintaining it by means of the wrought iron forged piece screwed to the side of the machine frame at B. This additional bearing sustained the shaft at a level, prevented springing and relieved the journals of unnecessary strain. Work of this sort can be done by any motor vehicle mechanic. The tendency in turning crank shafts for motor carriage service is to get the shafts too light, making them so limber that effective work can not be obtained unless the shafts are braced in the manner shown in the sketch. The braces can be made of wrought iron. Cast or pig iron contains a rather high percentage of silicon and carbon. What is known as "wrought iron" is cast or pig iron which has been freed as much as possible from the two elements above mentioned, and the greater the degree of refinement the greater the purity.



1



2



3

Sometimes we notice on the corners of the sheets a stamp mark guaranteeing that particular sheet to be "charcoal iron." This means that in the process used to manufacture that particular grade of iron, only charcoal was used, as it is well known that charcoal does not contain any sulphur or phosphorus, or other substance liable to contaminate the iron.

AS TO WORN GEARS.

When the cogs of the gears on the power transmission are worn as at C, Fig. 2, thus forming a prying lever between the wheels, remove the defective gear and put on a new one. When the gears open as in the instance shown the shafts spring and open proportionately, and irregular motion results. Gears of motors should be examined regularly to detect flaws of adjustment and improper alignment. Just as soon as a cog begins to wear, there will be endless grinding and prying until it is replaced with new. The trouble can be avoided by occasional overhauling and setting the gears so that the teeth mesh square and deep enough to clear and not bind. There are of course, many objections to toothed gearing, such as the necessity of keeping spare wheels to replace the break downs, the first cost in patterns and for fixtures, the trouble and expense of keeping them greased when working, noise, limit of speed and therefore limit of power, and danger in attending to them. No doubt many break downs are caused through gears working loose or cogs riding. Suppose a wheel on a crank shaft is cast double helical in form, but the wheel or the drive shaft actually consists of two separate wheels, each forming a single helical wheel, which fits exactly into the two halves of the helical wheel on the crank shaft. These two half wheels are allowed to run loose on the shaft and are kept from spreading by collars on the shaft at each side. Now, if they had one or more bars carried in suitable pockets on the inside of the rims of the wheels, and in the center of each of these bars or links an eye corresponding with and fitting a pin carried in a disk keyed to the shaft between the two half wheels, an arrangement would thus be provided which would allow for any end movement due to the wheel of the crank shaft being not quite true in the plane of its running, or to any other cause for end motion inasmuch as one of the half wheels would advance a little, while the other half would recede an equal distance from their originally true position, and at the same time both halves of the wheel would be kept in perfect touch with the corresponding helices on the driving wheel. This would in no way accelerate or retard the regularity of the motion transmitted to the shaft.

THE OIL INJECTOR.

In Fig. 3 is an oil injector designed for burning oil for motors. The oil is forced into the pipe, D, from the supply tanks and combined with steam. The steam supply is obtained through the main central pipe, E. The charges of both oil and steam are regulated by valves. This oil injector is adjusted between the fire doors beneath a boiler and the mixed steam and oil passes into the furnace through the pipe. The necessary quantities of air for effecting vaporization are admitted through prepared cavities in the sides of the furnace. The passage of the oil from the supply pipe, D, to the delivery end, is effected at F.

COMMUNICATIONS.

To Prevent Skidding.

New York, Jan. 19.

Editor Horseless Age:

Seeing the automobile slip from my window recalls to my mind a tire that we used to bolt on the outside of the other tire to make a broad-tired wagon for a broad tread, and it struck me that if something like the Hold Fast or Neverslip horseshoe calks could be put on such a tire, it could be slipped on the wheels of an automobile in a few minutes and avoid sliding. The loose tires I refer to are still advertised in some of the agricultural publications. Yours truly,

C. DE P. FIELD.

Explosive Motor Criticisms.

New York, Jan. 25.

Editor Horseless Age:

Permit me to offer a few criticisms on statements made in your Explosive Motor Number. These errors might not bother the old hands, but newcomers might find them troublesome.

In the drawing showing the De Dion motor the break in the current is shown as occurring on the secondary wire, while, of course, it is the primary wire that should be in connection with the current interrupter.

I think Mr. Clegg is wrong about a spark occurring when the contact is made in the primary circuit, as I have never been able to get one. The spark always occurs at the breaking of the circuit. The coil of a well-known maker is worked on this principle, there being a relatively long contact, with a sudden break.

In describing the De Dion interrupter, I think he is in error, and that the claim is only that one spark is produced, and no pretense that the spring can vibrate in the short time allowed. One good spark is all that is necessary.

I am surprised at the instructions given for making packing rings. Any one using this method will be likely to break as many as he gets finished. The easiest way is to turn the outside of the cylinder from which the rings are to be cut first, then shift it on the face plate or in the clutch to the necessary eccentricity, and then turn out the inside diameter. After this, face and cut off the rings. If the rings need further turning down to make a fit, it should be done before the cut is made at the thinnest part of the ring.

Another error, but of minor importance, is that the Daimler Co. regulate the speed by keeping the exhaust valve closed, not opened, as he says. Yours truly,

HENRY W. STRUSS.

The Inquirer's Fight in Philadelphia.

Philadelphia, Jan. 25.

Editor Horseless Age:

My attention has been called to Dr. Sweany's letter in your issue of the 24th. It is my intention to organize an Automobile Club in Philadelphia in the very near future, and could you not send me the rules and by-laws of the Automobile Club of New York? I feel quite confident that we will succeed in getting all the drives in Fairmount Park opened up for automobile use very early in the spring. The fight the Inquirer made against the Park Commission resulted in giving us a large number of miles of road. In fact, we can go anywhere in the park at the present time excepting the River Drive, on the east side of the Schuylkill. Yours very truly,

JAMES ELVERSON, Jr.

A Doubting Thomas.

New York, Jan. 29.

Editor Horseless Age:

In your issue of August, 1898, you published a patent issued to Nikola Tesla for a gas engine igniter. Being desirous of seeing how it would work, I tried the arrangement, using an induction coil giving a ⅜-in. spark, with an appropriate condenser and an ordinary spark coil. I found that I could get a spark on breaking the primary circuit, but that it was impossible to obtain one on making the circuit as claimed in the patent.

Now, I am curious to know if any other of your readers tried the experiment, and, if so, with what result.

H. W. S.

U. S. Storage Ignition Cells.

No subject is attracting more attention to-day among motor vehicle inventors than that of ignition, and in the ignition problem the battery is of prime importance. A storage battery specially recommended for this service is the U. S. Storage Battery No. 2, manufactured by the United States Storage Battery Co., 253 Broadway, New York, which, because of its high voltage, steady current, lightness and compactness, is claimed to be capable of doing more work with fewer cells than any other 5-ampere battery made.

The battery is shipped fully charged and assembled, save that the electrolyte is contained in a separate vessel until required for use. In this condition the full charge will be retained, until, by addition of the electrolyte, the battery is put in active condition, after which it may be discharged and recharged as often as desired.

Another great advantage is the high electro-motive force maintained throughout the discharge, as, even after withdrawing current to the full rated capacity, 2 volts will be registered. The point reached by the battery when at maximum charge is 2½ volts, said to be half a volt higher than any other storage battery made.

The creeping of salts over the edge of the cell is said to be absolutely prevented, both in the sealed and removable cover type. Current leakage is also prevented by this same construction.

The manufacturers give the following table of efficiency of these batteries:

Voltage (open circuit)	2.5
Voltage (closed circuit)	2.35
Capacity (ampere hours)	5
Discharge rate in amperes (normal)	0.50
Discharge rate in amperes (safe maximum)	1.0
Recharge rate, 1½ amperes for	3½ hrs.
Internal resistance, ohm	0.25

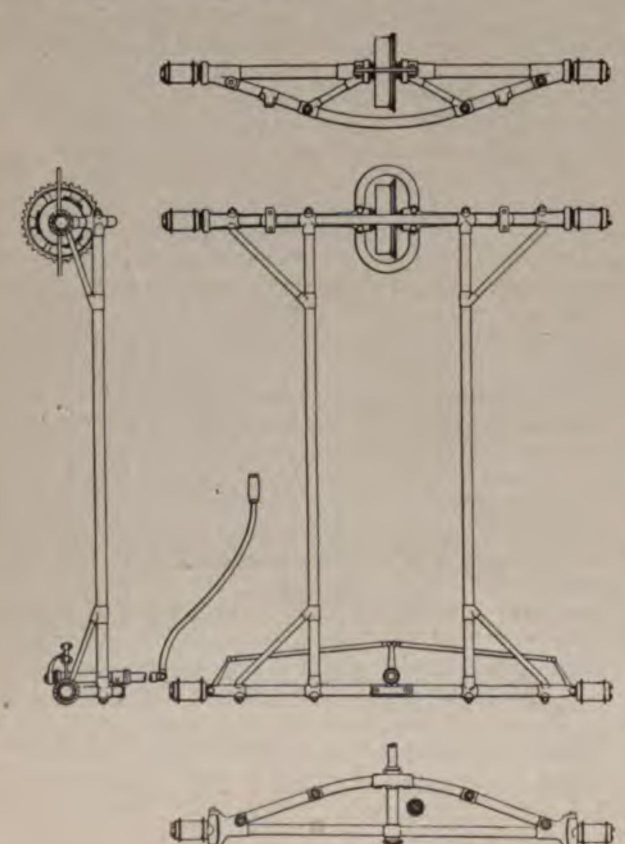
Weight of cell complete	2 lbs.
Weight of elements and electrolyte	17 oz.
Height of jar	$4\frac{3}{4}$ in.
Height of jar over all	6 in.
Diameter of Jar, at top	3 in.

Complete Running Gears.

The accompanying illustration shows a running gear, which the Milwaukee Automobile Co. are supplying to the trade. They do not furnish separate parts. The gear consists, as will be seen, of a front and rear truss securely tied together by distance tubes, which contain universal joints. The entire structure is built of $1\frac{1}{4}$-in. seamless tubing, strongly braced together, and has frame connections of steel of the best quality, riveted and braced in place.

The front truss carries the front wheels and complete steering linkage. This apparatus enables a movement of 60 deg. to be given the front wheels, which controls the carriage with ease at any speed, and will turn it completely around in a 15-ft. circle.

The rear truss carries the driving mechanism and rear wheels. A compensating gear is provided in the middle of this truss to allow for unequal speeds of each rear wheel. The gears of this device are of crucible steel, while the axles are the best quality of open hearth machinery steel, and the hubs are keyed on in the most secure manner. The main driving sprocket (which also carries the brake shoe), has 30 teeth, 1-in. pitch, and 5-16 in. wide.



The bearings throughout are of tool steel, hardened and ground to a finish. They have ball retainers and are dust proof.

This frame is 4 ft. 10 in. between the front and rear truss, and is designed for a 4 ft. 2 in. track, with equal sized wheels. Its construction gives great rigidity, in combination with minimum weight. They supply it complete, ready for enameling, as shown, so that the wheels can be built on the hubs, and any carriage body with springs, motor, tanks, etc., placed on it. They can make delivery promptly on receipt of order.

The Auto-Sparker.

Another new sparking dynamo has made its appearance, called the "Auto-Sparker." It is not a magneto machine, but a dynamo specially wound and perfectly balanced, getting its power from a small rawhide pulley held in contact with the fly wheel by a tension spring. The pulley is made small enough to give a speed at starting upon a movement of the fly wheel such as is necessary in the use of the best batteries. As the engine speeds up the governors fly out and press a tapering sleeve on the shaft against an inclined steel point, thus lifting the pulley off the fly wheel just sufficient to hold the speed down steady, no matter what the size or speed of the fly wheel.

The claims made for these sparkers are:

First—That they will start gasoline engines as easily as the best batteries.

Second—That they make a more reliable spark, and that the spark does not burn up the electrodes as batteries or other differently wound dynamos do.

Third—That they will save their entire cost in one year, as the only expense is 5 cents' worth of oil and possibly a new set of brushes (20 cents) once a year.

Fourth—That the machines are durable, there being nothing to wear out but one axle and a rawhide pulley, and these ought to last for years.

The machine is manufactured by the Motsinger Device Mfg. Co., Pendleton, Ind.

Dow Special Motor Vehicle Batteries.

The Dow Portable Electric Assistant Co., 218 Tremont St., Boston, Mass., and 1135 Broadway, New York, have recently placed on the market two special batteries for sparking gasoline motors, known as their Nos. 66 and 44 Compound Batteries. In No. 66 the resistance switch is made interchangeable, so that when the battery wears out the switch can be taken off, which makes a saving of 50 cents in the cost of the second battery. The battery is $8\frac{1}{2}$ in. high, $8\frac{5}{8}$ in. long and 5 9-16 in. wide, weighs 16 lbs., and is made specially for motor carriage use. It registers 8 to 9 volts and 8 to 10 amperes.

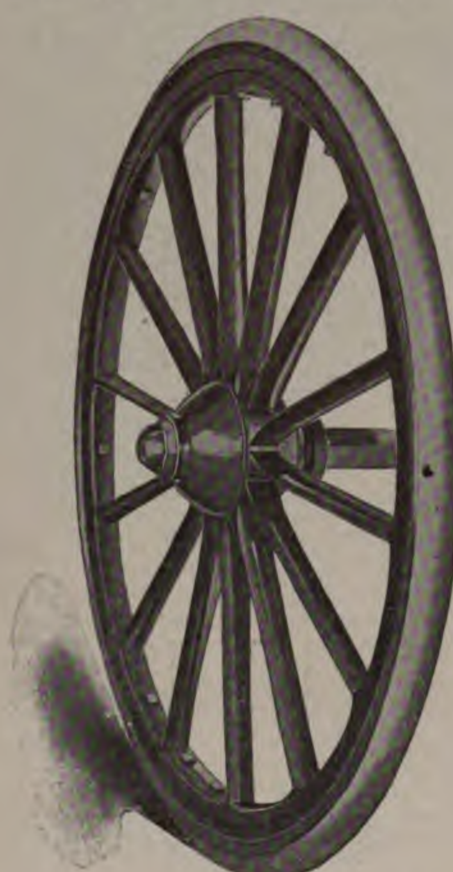
The No. 44 can, if desired, be furnished with a rheostat switch the same as No. 66, but at extra cost. In size it is 8 in. high, $2\frac{3}{4}$ in. wide, and 11 in. long, with round ends. Weight, 11 lbs. This battery is made for economy of space, and is successfully used on pacing machines and motor carriages.

The company request that in ordering batteries customers state the number of volts and amperes required, kind of spark and whether high tension or spark coil is used.

Size and Wall.	DISTANCE BETWEEN SUPPORTS IN INCHES.										
	12″ Lbs.	18″ Lbs.	24″ Lbs.	30″ Lbs.	36″ Lbs.	42″ Lbs.	48″ Lbs.	54″ Lbs.	60″ Lbs.	66″ Lbs.	72″ Lbs.
¾ x 1/32	60	40	30	24	20	17	15	13	12	11	10
¾ x 1/16	107	71	53	42	35	30	26	23	21	19	17
¾ x 3/32	141	94	70	56	47	40	35	31	28	25	23
¾ x ⅛	166	110	83	66	55	47	41	36	33	30	27
⅞ x 1/32	84	56	42	33	28	24	21	18	16	15	14
⅞ x 1/16	151	100	75	60	50	43	37	33	30	27	25
⅞ x 3/32	203	135	101	81	67	58	50	45	40	37	33
⅞ x ⅛	243	162	121	97	81	69	60	54	48	44	40
1 x 1/32	111	74	55	44	37	31	27	24	22	20	18
1 x 1/16	203	135	101	81	67	58	50	45	40	36	33
1 x 3/32	276	184	138	110	92	79	69	61	55	50	46
1 x ⅛	335	223	167	134	111	95	83	74	67	61	55
1⅛ x 1/32	142	95	71	57	47	40	35	31	28	25	23
1⅛ x 1/16	262	175	131	105	87	75	65	58	52	47	43
1⅛ x 3/32	361	241	180	144	120	103	90	80	72	65	60
1⅛ x ⅛	443	295	221	177	147	126	110	98	88	79	73
1⅛ x 5/32	508	339	254	203	169	145	127	113	101	92	84
1⅛ x 3/16	561	377	280	224	187	160	140	124	112	102	93
1¼ x 1/32	177	118	88	71	59	50	44	39	35	32	29
1¼ x 1/16	329	219	164	131	109	94	82	73	65	59	54
1¼ x 3/32	458	305	229	183	152	130	114	101	91	83	76
1¼ x ⅛	566	377	283	226	188	161	141	125	113	102	94
1¼ x 5/32	655	436	327	262	218	187	163	156	131	119	109
1¼ x 3/16	728	485	364	291	242	208	182	161	145	132	121
1¼ x 7/32	787	525	393	315	262	225	196	175	157	143	131
1¼ x ¼	834	556	417	333	278	238	208	185	166	151	139
1⅜ x 1/32	217	144	108	86	72	62	54	48	43	39	36
1⅜ x 1/16	404	269	202	161	134	115	101	89	80	73	67
1⅜ x 3/32	566	377	283	226	188	161	142	125	113	103	94
1⅜ x ⅛	704	469	352	281	234	201	176	156	140	126	117
1⅜ x 5/32	820	547	410	328	273	234	205	182	164	149	136
1⅜ x 3/16	919	612	459	367	306	262	229	204	183	167	153
1⅜ x 7/32	1000	667	500	400	333	288	250	222	200	181	166
1⅜ x ¼	1065	711	533	426	355	304	266	237	213	194	177
1½ x 1/32	259	172	129	103	86	74	64	57	51	47	43
1½ x 1/16	486	324	243	194	162	138	121	108	97	88	81
1½ x 3/32	685	457	342	274	228	196	171	152	137	122	114
1½ x ⅛	857	571	428	343	285	245	214	190	171	155	142
1½ x 5/32	1006	670	503	402	335	287	251	223	201	182	167
1½ x 3/16	1132	754	566	452	377	323	283	251	226	205	188
1½ x 7/32	1239	826	629	495	413	354	309	275	247	223	206
1½ x ¼	1329	886	664	531	443	376	332	295	265	241	221
1⅝ x 1/32	306	204	153	122	102	87	76	68	61	55	51
1⅝ x 1/16	577	384	288	230	192	164	144	127	115	105	96
1⅝ x 3/32	816	534	408	326	272	233	204	181	163	148	136
1⅝ x ⅛	1025	684	513	410	341	293	256	228	205	186	170
1⅝ x 5/32	1210	806	605	484	403	345	302	267	242	220	201
1⅝ x 3/16	1369	912	684	547	456	391	342	304	273	248	228
1⅝ x 7/32	1505	1003	752	602	501	431	376	335	301	273	250
1⅝ x ¼	1622	1081	811	649	540	463	405	360	324	295	270
1⅝ x 9/32	1721	1147	860	688	573	491	430	382	344	313	286
1⅝ x 5/16	1804	1202	902	721	601	515	451	401	360	326	300
1¾ x 1/32	356	237	178	142	118	105	89	79	71	64	59
1¾ x 1/16	675	449	337	269	225	192	168	149	134	122	112
1¾ x 3/32	959	639	479	383	319	274	239	213	191	174	159
1¾ x ⅛	1210	807	605	484	403	345	302	269	242	220	201
1¾ x 5/32	1433	955	716	573	477	409	358	318	286	260	238
1¾ x 3/16	1628	1085	814	651	576	465	407	361	325	296	271
1¾ x 7/32	1798	1199	899	719	599	513	449	399	359	327	299
1¾ x ¼	1946	1297	973	778	648	556	486	432	389	353	324
1¾ x 9/32	2073	1382	1036	829	691	592	518	460	414	376	345
1¾ x 5/16	2180	1454	1090	872	726	623	545	484	436	396	363
1¾ x 11/32	2273	1515	1136	909	757	649	568	505	454	413	378
1¾ x ⅜	2405	1603	1202	962	801	687	601	534	481	437	400
1⅞ x 1/32	408	272	204	163	136	116	102	90	81	74	68
1⅞ x 1/16	780	520	390	312	260	223	195	173	156	142	130
1⅞ x 3/32	1113	742	556	445	371	318	278	247	222	202	185
1⅞ x ⅛	1410	940	705	564	470	402	352	313	282	256	235
1⅞ x 5/32	1675	1117	837	670	558	478	418	372	335	304	279
1⅞ x 3/16	1910	1273	955	764	636	545	477	424	382	347	318
1⅞ x 7/32	2118	1412	1059	847	706	605	529	470	423	385	353
1⅞ x ¼	2300	1533	1150	920	766	657	575	511	460	423	383
1⅞ x 9/32	2459	1639	1229	983	819	702	614	546	491	447	409
1⅞ x 5/16	2596	1731	1298	1038	865	741	639	577	519	472	432
1⅞ x 11/32	2714	1819	1357	1085	904	775	678	603	542	493	452
1⅞ x ⅜	2815	1877	1408	1126	938	804	704	625	563	512	469
1⅞ x 13/32	2902	1935	1451	1160	967	827	725	645	580	525	483
1⅞ x 7/16	2974	1982	1487	1189	991	849	743	660	594	540	495
2 x 1/32	468	312	234	187	156	133	117	104	93	85	78
2 x 1/16	893	595	446	357	297	255	223	198	178	162	148
2 x 3/32	1275	850	637	510	425	364	318	283	255	232	212
2 x ⅛	1625	1083	812	650	541	464	406	361	325	295	270
2 x 5/32	1936	1291	968	774	645	553	484	430	387	352	322
2 x 3/16	2215	1477	1107	886	771	633	553	492	443	402	385
2 x 7/32	2464	1642	1232	985	821	704	616	558	492	448	410
2 x ¼	2685	1790	1342	1074	895	767	671	596	537	488	447
2 x 9/32	2879	1919	1439	1151	959	822	719	639	575	523	479
2 x 5/16	3049	2033	1524	1219	1016	871	762	677	609	554	508
2 x 11/32	3191	2127	1595	1276	1064	911	797	709	638	580	532
2 x ⅜	3328	2218	1664	1331	1109	950	832	739	665	605	554
2 x 13/32	3441	2294	1720	1376	1147	983	860	764	688	625	573
2 x 7/16	3534	2356	1767	1413	1178	1009	883	785	706	642	589
2 x 15/32	3615	2410	1807	1446	1205	1032	903	803	723	657	602
2 x ½	3681	2454	1840	1472	1227	1051	920	817	736	669	613

Empire Ball Bearing Axles.

The importance of anti-friction bearings on motor vehicle axles is generally recognized. This is particularly true of heavy vehicles, where the loads carried are correspondingly heavy. Among the earliest to recognize the future of ball bearings for vehicles, and to develop serviceable bearings, was



the Chicago Screw Co., 40 W. Washington St., Chicago, Ill., manufacturers of the Empire Ball Bearing Axles and of Roberts' Motor Vehicle Wheel, illustrated here. Their bearings have been used on the electric cabs in New York, and even on trucks carrying loads of 52,000 lbs. These ball bearing axles are made in all sizes, varying from 5/8 to 4½ in.

Portable Tire Pump.

The Gleason-Peters Air Pump Co., 20 W. Houston St., New York, are making a portable tire pump, which is capable of inflating even the heaviest automobile tires. At the Cycle Show this little pump was shown in operation on a 5-in. cab tire working against a pressure of 200 lbs. to the square inch. The cylinder is 1½ x 9 in., and the capacity of it 17 cu. in. The secret of the great power of the little pump is found in the toggle joint principle of the lever.

The Gleason-Peters Co. are also preparing to furnish seamless steel drawn tanks of any desired diameter or length, specially constructed to hold gasoline or air and fitted with small 2-in. gauges that will not be injured by vibration.

The Gordon Bennett International Challenge Cup.

In London automobile circles considerable disappointment is felt that no challenge has been sent on behalf of English motorists to compete for this cup. The Automobile Club committee have been approaching all the known owners of racing automobiles in the United Kingdom, but no response was received, so that for 1900, at least, England will lay quiet. Challenges have been received by the French Automobile Club from the clubs of Germany, France, America and Italy. The date of the race is June 14, but the route over which it will be run is not yet fixed.

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

THE JUMP SPARK LEADS
Give Thick
1 Inch Jump Spark.
Weight, 8 lbs.
Dimensions, 8x4x4 ins.
Patent Applied For.
C. F. SPLITDORF, ELECTRICAL SPECIALTIES
21 Vandewater St., New York.

WANTED.

Locomobile or other good steam carriage. Address with full particulars and lowest cash price,
JAMES W. HENDERSON,
Room 1206, 71 Broadway, New York.

WANTED.

Light, second-hand Automobile, steam or gasoline; powerful, good hill climber. Must be cheap.
Address M. L. A., care of HORSELESS AGE.

FOR SALE.

Stanley Locomobile, Model 3, full leather upholstering and top. Run 5 miles. New and in perfect condition. Three hours from New York. Cost $900. Price $850. Address Physician's Carriage, care of HORSELESS AGE.

WANTED LOCOMOBILE.

Will give $500 for Stanley Locomobile in perfect condition, delivered in Milwaukee or Chicago.
Address "Want," care of HORSELESS AGE.

NEW SAFETY DEVICE

AGAINST LOW WATER in SMALL STEAM BOILERS.
Indispensable for use on STEAM CARRIAGES.
Can be readily attached to any make of boiler.
SMART & SPENCER, Sole Agents, SALEM, MASS.

Graphite Lubricants,

ALL KINDS, ACCORDING TO WANTS.

Special preparations for Gears of Electric Motors and for Cylinders of Motor Engines. Send for Circulars and Prices.

Joseph Dixon Crucible Co., - Jersey City, N. J.

SPARKING POINTS

For electric ignition in Gas, Gasoline and Oil Engines. We make a special Sparking Point for this service, possessing extreme hardness and durability. Send for descriptive matter and prices.

BAKER & CO.,
Manufacturers of Platinum Products in all forms and sizes,
NEW YORK OFFICE, 120 Liberty St. NEWARK, N. J.

BALL BEARINGS, ANY STYLE, TO ORDER.

DODGE MACHINE SCREW CO.,
BOSTON.

FOR SALE.

GENUINE PANHARD-LEVASSOR. Bought new in Paris October, 1899. Cost to import over $3,200. 4 H. P., 2 cylinders; pneumatic tires. In first-class condition, but having no further use for same will sell for $1,800 *cash*. CHARLES T. JEFFERY, 52 Institute Place, Chicago.

STEEL BALLS, OF VARIOUS DIAMETERS.

GEAR WHEELS, 3,200 SIZES.
DRIVE CHAIN SPROCKETS.
COMPENSATING BEVEL GEARS.

BOSTON GEAR WORKS, 138 Purchase Street, Boston, Mass.

BALDWIN DETACHABLE CHAINS

made for Automobiles, in sizes to suit all requirements. Prompt deliveries made. Address:
BALDWIN CYCLE CHAIN CO.,
WORCESTER, MASS., U. S. A.

LEONARD HUNTRESS DYER,

Specialty: Patents and Patent Causes,

908 G Street, N. W.
Cable Address: "Dyerpatent, Washington." **WASHINGTON.**

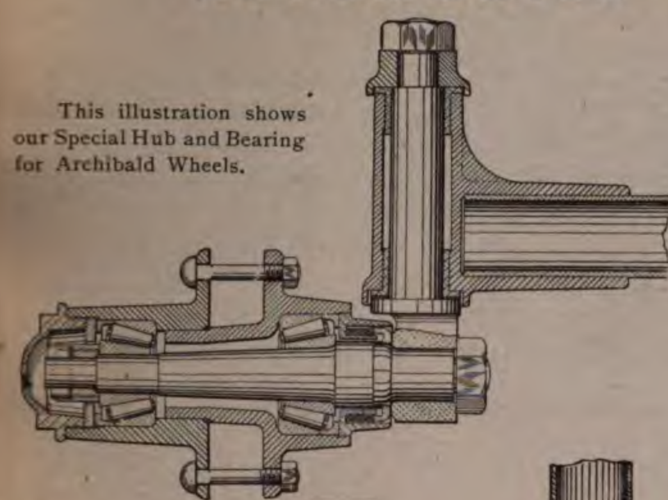
Automobile Storage and Repair Co.

Station No. 1—57 WEST 66th STREET (St. Nicholas Rink Bldg.), NEW YORK.

House and Care for Automobiles of all kinds. Storage Batteries Charged and Supplies of all kinds furnished.

Transients Accommodated.

AUTOMOBILE ACCESSORIES.



This illustration shows our Special Hub and Bearing for Archibald Wheels.

GUIDING HINGE : : :

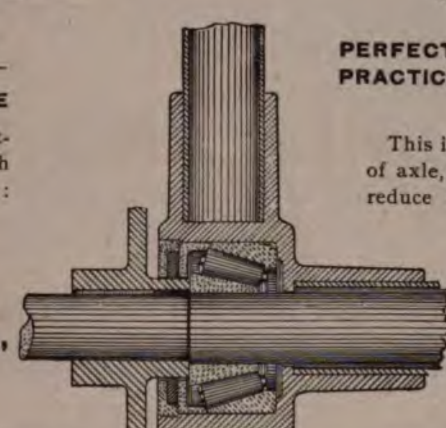
Our Hinge is made from the best of steel. Used with either style of Grant bearings to suit wheels.

REAR AXLE BEARINGS

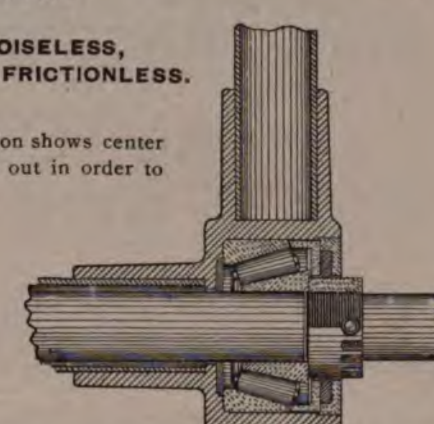
For Differential Drive.

This style bearing forms the rear corner pieces for frame upon which the springs are fastened.

PERFECTLY NOISELESS,
PRACTICALLY FRICTIONLESS.



This illustration shows center of axle, broken out in order to reduce size.



WRITE US FOR CATALOGUE

We can also furnish wheels fitted with bearings and tired with Kelly Solid Rubber Tire : : : : :

THE GRANT
AXLE & WHEEL CO.,
SPRINGFIELD, OHIO.
Box 750.

Sole Licensees

UNDER THE TILLINGHAST PATENTS.

HAVING acquired the Tillinghast Patents, heretofore held by Theodore A. Dodge, the Single Tube Automobile and Bicycle Tire Company gives notice that the following companies alone are licensed to manufacture and sell Single Tube Tires under said Letters Patent.

HARTFORD RUBBER WORKS COMPANY
B. F. GOODRICH COMPANY
DIAMOND RUBBER COMPANY
KOKOMO RUBBER COMPANY
GOODYEAR TIRE & RUBBER COMPANY
INDIA RUBBER COMPANY
NEW BRUNSWICK TIRE COMPANY
NATIONAL INDIA RUBBER CO.
INDIANA RUBBER & INSULATED WIRE CO.
MECHANICAL FABRIC COMPANY
BOSTON WOVEN HOSE & RUBBER COMPANY
HODGMAN RUBBER COMPANY
REVERE RUBBER COMPANY
PENNSYLVANIA RUBBER COMPANY
FISK RUBBER COMPANY
EMPIRE RUBBER MFG. CO.
NEWTON RUBBER WORKS
L. C. CHASE & COMPANY
INTERNATIONAL AUTOMOBILE & VEHICLE TIRE COMPANY
PHILADELPHIA RUBBER COMPANY

SINGLE TUBE AUTOMOBILE AND BICYCLE TIRE CO.

THEODORE A. DODGE, President.

TRANSMISSION GEARING. . . . FOR AUTOMOBILES

(Patents allowed and pending.)

Express Wagon Size. Weight 38 lbs.

COLCORD UPTON, Beverly, Mass.

HAND AND POWER PUMPS For Users and Makers of Automobiles and Pneumatic Tired Wagons. . . . . . .

GLEASON-PETERS AIR PUMP CO.,

MANUFACTURERS,

20 WEST HOUSTON STREET, NEW YORK, U. S. A.

THE DOW COMPOUND BATTERY IS THE BEST IN THE MARKET FOR **Automobile Work**

For prices and particulars send to

THE DOW PORTABLE Electric Assistant Co.,

OFFICES:
1135 Broadway, New York.
218 Tremont St., Boston, Mass.

$\frac{1}{2}$ to 2 H. P. Gasoline Motors

(WITH OR WITHOUT WATER JACKET)

FOR

AUTOMOBILES AND LAUNCHES.

VERTICAL OR HORIZONTAL.
ELECTRIC IGNITION. :: ::

☞ Large factory suitable for experimental work. Any style of carriage built to order from owner's drawings. Larger sizes for heavy vehicles in course of construction.

MALTBY AUTOMOBILE CO.,

10-12 Clinton Street, Brooklyn, N. Y.

SPECIAL OFFER.

BACK NUMBERS.

We have no more complete files and have decided to offer miscellaneous back numbers of THE HORSELESS AGE, from December, 1895, to March, 1899, at the following prices:

12 Assorted, - - - $1.00
6 " - - - - 50 cents.
Foreign, 5 and 2½ shillings, respectively.

THE HORSELESS AGE,

American Tract Society Building, Nassau and Spruce Streets, ***NEW YORK.***

.....THE MOTOR TIRE.....

that has given the best satisfaction. It's been tried under all conditions and we have yet to receive a complaint.

WRITE FOR PRICES AND CATALOGUE.

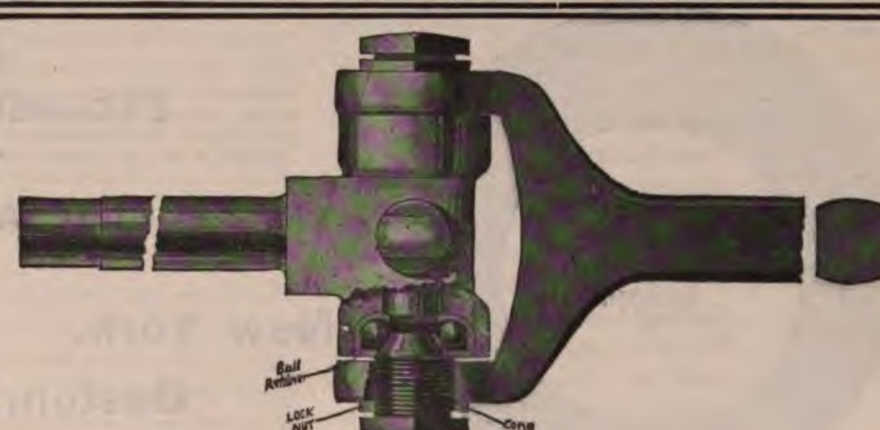
THE GOODYEAR TIRE & RUBBER CO., Akron, Ohio, U. S. A.

MOTOR WHEELS.

STEERING DEVICE

WITH

BALL BEARINGS.



RIMS. CRESCENT SHAPE AND FLAT BASE

FLARING EDGES IF DESIRED.

WESTON-MOTT CO., UTICA, N. Y.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. V. NEW YORK, FEBRUARY 7, 1900. No. 19.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

We Draw the Line.

Our readers will not be surprised to hear that we have refused the advertisement of the Anglo-American Rapid Vehicle Co. We have taken this stand on grounds of public policy, and for the protection of an industry which the promoters of this enterprise are seeking to debauch. In their attempt to float in the United States a $75,000,000 corporation based on the ownership of foreign patents and on the combination of alleged powerful manufacturers of automobiles, etc., in England and the United States, they have sunk to the level of the "green goods" men whose records appear in the police annals of our large American cities. The English companies said to be embraced in the combine are offshoots and ramifications of the British Motor Co., a promotion job, which H. J. Lawson, Pennington and others launched in London several years ago, to their own enrichment and the everlasting detriment of the motor vehicle industry. The scheme was so outrageously overcapitalized and flagrantly mismanaged that the glowing prospectus of the promoters now reads to the shareholders like a work of fiction. General dissatisfaction and charges of a serious nature followed their scandalous financiering, and the unsatisfactory state of their enterprises there has no doubt prompted them to try their fortunes in America, where they imagine a "fake" motor boom may be worked up with the same buncombe and beating of tom-toms that won success for them in England three years ago.

The methods of these men are familiar to all students of human nature and observers of the development of new industries. They first subsidize a servile and venal press, which prostitutes itself by the printing and circulation of the gross exaggerations and misrepresentations of the "syndicate." They keep themselves in the public eye by every means available. They are noisy and conspicuous in public places, at fashionable hotels and on the streets. They cover themselves with diamonds to excite the cupidity of the vulgar and the artless, swagger about like swashbucklers, and talk glibly of millions made in their enterprises. Often they are suave, sleek and insinuating in demeanor, even obsequious, upon occasion. Or it may be that the real plotters of the scheme are careful to conceal themselves behind the swashbucklers and the braggarts, who are merely deputized to carry through a programme which more crafty men lay out. Generally, large schemes of this kind include in their personnel all classes of talent required to carry through the colossal "bluff."

Every well-appointed stock-jobbing organization generally includes in its personnel all classes of such financial talent—wheedlers, boodlers, prevaricators, bulldozers and intriguers—each having his special part to play in the great game of "bluff." The plan unfolds. Principals and henchmen perform their parts with vigor and skill. The weak and the confiding are convinced by the clamor and strong assertion that the "syndicate" is very powerful and intends to control these

things absolutely by means of patents wide as the world and solid as Gibraltar; that it has the backing of a whole galaxy of financial and social lights, who are not averse to lending their names to any shameful scheme which will bring them gain, no matter what it brings to the investors. In the midst of the bluster and the glitter the unwary are ensnared. The "syndicate," with a great flourish of trumpets, unloads upon the unsuspecting public and then divides the spoils behind the scenes. Such is the modus operandi of that respectable method of swindling known as stock-jobbing. The Anglo-American Co. understands it well, and the incantation will now begin. Advertisements will be placed, motor races are being scheduled, interviews galore are appearing in a subservient press, and when the hubbub has reached its height they will endeavor to dispose of their shares. Will they succeed? For the sake of a long-suffering public and an industry degraded and misused, we hope not, and we decline to in any way aid or abet the brazen scheme. We want no Anglo-American or Lead Cab advertisements.

But what of the investors in these blatherskite schemes? The scene now changes. Somebody must grapple with the situation in a practical manner and endeavor to earn the glorious dividends which the promoters have painted for the shareholders. Difficulties at once present themselves. First-class business talent is hard to find, and seldom allies itself with such doubtful enterprises. Patents are discovered to be far less essential than practical manufacturing ability, which the promoters, of course, among all the bundles of trumpery which they have turned over to the dear public, have failed to furnish. Mismanagement invariably results, stockholders become dissatisfied, the business is still further crippled by dissension, until finally the truth is laid bare—the investors have been grossly swindled by that legalized "green goods" game known as stock-jobbing or stock-watering, a species of financiering which is more extensively practiced and more winked at in the United States of America than anywhere else in the world to-day.

Let us look a little further into the consequences of these promotions in the incipient stages of an industry. The immediate effect is to deter honest and competent men from entering the business. Such of them as are not deceived by the fanfaronade and bluster of the promoters prefer not to "mix up" in the industry while it is resting under the stigma of the stock-jobber. Others, half persuaded that there may be some truth in the preposterous claims of the boomers, also decide to wait the turn of affairs. Thus, the recruits which the new industry manages to pick up during this unsettled period are mainly the dupes of the promoters or the enthusiasts who come and go in the formative periods of all new industries. The substantial element looks on with suspicion, and delayed industrial development is the necessary consequence.

And what of the deluded investors, when the rude awakening comes? Their money sunk in unprofitable enterprise, do they take a kindly view of the industry whose name has been employed to cajole them? Are they not rather embittered and moved to freely express unfavorable opinions to their friends? Is such advertisement desirable for a new industry? We trow not. Unfortunately, the motor vehicle industry has had too much of such advertisement already. Will the Anglo-American promoters succeed in giving it more unpleasant notoriety? Surely not, unless the American public is fallen to the level of gudgeons and fools, and the leaders of the industry here are destitute of moral fiber and of commercial foresight. These parasites must not be allowed to fasten themselves upon the American industry.

The claims advanced for their patents and other assets by this wind blast from England are preposterous—so preposterous that if we did not know their duplicity we should suspect their sanity. The odds and ends of European patents which they bought up to float their original scheme are of little value on this side of the water. Some of them have or have had commercial value abroad, but conditions are so different in the United States that the construction of both motors and vehicles must be changed to meet them. Fundamental patents there are none, either in the possession of this "syndicate" or any one else. The field is open to all who have the ability and the capital to produce what the public demands. As to the good will of most of these companies composing the Lawson-Pennington syndicate, it may be properly described as a stench. The vehicles they are said to be preparing to manufacture here are of the lightest construction, built for show or for a short dash, and unfitted for road service. These same vehicles have been advertised and puffed in England for several years past, and tall stories have been told of the thousands that were being turned out for the foreign and domestic trade. Up to the present time, however, an expectant world is still waiting for this plethora of motor vehicles.

The following is clipped from the London Financial News of Jan. 22:

A New York correspondent informs us that some interest is being worked up in the Pennington Motor Co., Ltd., on that side of the water, from the offices of the Anglo-American Rapid Vehicle Co., and asks for information with respect to these companies. This information we are able to afford, and we hope it may be of use to investors in the United States.

The Pennington Motor Co., Ltd., was registered in London, on Jan. 21, 1897, with a capital of £100,000 in £1 shares. There are no articles of association. The file at Somerset House is by no means voluminous; but we observe a letter upon it which seems to show that the authorities had at one time entertained doubts as to whether the company had disappeared. The letter is from Mr. William Jordan (one of the signatories), of 55 Highbury Park, London, N., and is dated Oct. 13, 1898. It was evidently written in reply to a complaint that the company had made no return for 1897, and the writer says that he does not know whether the company is carrying on business or not, and that he never had any interest in it. His name, however, appears among the list of shareholders, which is as follows

Jordan, W., 55 Highbury Park, N.	1
Newman, H. C., 230 Lancaster Road, W.	1
Hayward, G. C., 6 Torriano Gardens, N. W.	1
Shields, F., 8 Bell Yard, W. C.	1
Gurney, W. C., 22 Stanley Road, N.	1
Webb, G. J., 48 Rattray Road, S. W.	1
Gray, A., 46 Pomeroy Road, S. E.	1

These names appear in a return dated Dec. 31, 1898, and filed on April 14, 1899. From this list it would seem that only seven shares have been issued; but there has evidently been a greater issue than this, judging from the terms of an agreement which is on the file, and which is dated Sept. 21, 1899. The agreement is between Edward Joel Pennington and William Baines, of 5 and 6 Great Winchester St., of the one part, and the Pennington Motor Co. of the other. E. J. Pennington and W. Baines agree, in consideration of 5,000 £1 shares (such shares to allow of a preference of 6 per cent. dividend to 10,000 £1 shares, to be hereafter issued by the company to secure the working capital required until these shares receive the 6 per cent. dividend, when all shares will rank equally), to personally instruct and assist on any business premises of the company one or more, but not exceeding four, workmen or other persons, to be named by the company for that purpose, in the process and details of the manufacture of articles under the aforesaid patents until such persons can manufacture the same without supervision and to the satisfaction of the directors of the company. On Oct. 30, 1899, the offices of the company were at 40 Holborn Viaduct; on Dec 20, 1899, they had apparently been removed to No. 41. The foregoing is as much as the file tells us about the Pennington Motor Co., Ltd. It will be obvious that there is more than one hiatus in the record.

A little more detailed information is available at Somerset House with regard to the Pennington Motor Foreign Patents Syndicate, registered on May 14, 1896, with a capital of £100,000 in £1 shares. One of the documents of chief interest on file is an agreement, made May 9, 1896, between Thomas Kane, of Chicago, Ill. (U. S. A.) (by his attorney, J. B. Carse, in London), and E. J. Pennington (the vendors), of the same place, of the one part and William Baines the younger, of 5 and 6 Great Winchester St., on behalf of the company. Under this agreement the vendors sold the patent rights of the Kane-Pennington motor for Austria, Argentina, Brazil, Canada, Denmark, Hungary, Egypt, Italy, Mexico, Newfoundland, Norway, Portugal, Russia, Spain, Sweden, Switzerland, Turkey, India, Ceylon, British Honduras, Congo Free State, Mauritius, Straits Settlement, Trinidad and all other countries for which patents had not been applied for up to April 23, 1896, the purchase consideration being fixed at 80,000 fully paid shares. There is also on the file a significant record of the circumstance that on Nov. 16, 1897, J. S. White obtained judgment for £250, and was declared entitled to rescission of agreement and to the rectification of the share register by the removal of his name. The registered offices of the company were at first at 5 and 6 Great Winchester St., E. C.; but on June 19, 1899, there is a notification to the effect that they have been removed to 142-143, Palmerston Buildings, Old Broad St., E. C.

From a return dated Dec. 31, 1898, it appears that of the 100,000 shares of which the company's capital consists, there had been 98,142 issued and taken up at that date. Of these, 80,000 were agreed to be considered as fully paid, and on the remaining 18,142 calls to the amount of 6s. per share had been made. The sum of £895 17s. represents calls unpaid. The following list of shareholders is furnished:

Toulmin, J. H., Bamber Bridge	6,000
Duffield, J., Ashfield, Worthington	1,500
Howard, J. H., Bedford	1,000
Anderson, G., Arbroath Foundry, N. B.	1,500
Fry, Sir Theodore, baronet	200
Sullivan, Sir Edward, baronet, Dublin	200
Leslie, G. J., 5 Copthall Buildings, E. C.	250
Kinlock, J. S., 47 Fishergate Hill, Preston	250
Judd, W. D., 4 Portland Road, Gravesend	25
Carter, R., 67 Avondale Road, Southport	20
Head, F. W., Southport	20
Toulmin, Mrs., Withy Grove, Bamber Bridge	300
White, Mary J., 43 Hurst Grove, Bedford	10
Marten, F. J., Gravenhurst, Bedfordshire	10
Tuck, S. N., 165 Kensington High St.	20
Jones, G. F., 36 Gorse Lane, Swansea	25
Barlace, J. B., 11 Harlesden Gardens, N. W.	25
Plowman, A., Gravenhurst, Bedfordshire	50
Plowman, A., Shefford, Bedfordshire	10
Soper, F. W., 19 Woodville Road, Ealing	50
Bond, A. E., 36 Connaught Road, N. W.	50
Jones, R., 18 Stockenchurch St., Fulham	50
Over, H. W., Rokeby, Sunnyside Road, Ealing	50
Millbourn, R., 55 Scarsdale Villas, W.	50
Roberts, J. L., The Square, Millom	120
Toulmin, G., 13 Doughty St., W. C.	450
Mace, J. H., Broaderick Road, Upper Tooting, S. W.	200
Sturmey, J. J. H., Cyclist newspaper	200
Toulmin, George, 33 Westcliff, Preston	500
Starley, J. K., Coventry	1,000
Baines, W., 5 Great Winchester St., E. C.	10,000
Blumfield, T. W., 11 Wren St., Coventry	100
Callaghan, 13 Queen's Road, Coventry	100
Pennington, E. J., Coventry	18,875
Carse, J. B., 1 Novarra Terrace, Bray	2,250
Rogers, W. W., 5 Great Winchester St.	51
Roork, J., Enderby Court, Wellington Road, Ashton-on-Ribble	50
Webb, A., Victoria Park, N. E.	101
Storer, W. M., Southport	200
Sergeant, F. R., Southport	165
Burn, Matthew James; Berridge, T. H. D.	* 105
Cheesewright, W. F., 11 Fairholme Road	75
Baines, W.; Pennington, E. J.	2,475
Baines, Mrs., Crosby, Liverpool	10,530
Webb., J., 57½ Old Broad St.	1
Cox, A. E., 5 Great Winchester St.	1
Rogers, S., 4 Westfield Villas, Wanstead	1
Phillips, F., Ashleigh House, Coventry	250
Knowles, T., Fleetwood	4,950
Waddington, J., Ashton-on-Ribble	50
Makinson, W. G., Ashton-on-Ribble	150
Norris, W., 42 Florence Road, N.	100
Fry, Sir Theodore; Sullivan, Sir Edward	14,400
Kane, T., Wabash Ave., Chicago, U. S. A.	18,875

We have no information showing whether either of the above companies has earned or distributed any dividend. It is also worth noting that in the agreement filed in the case of the second company no mention is made of any patent rights having been acquired by the vendors in the United States—the country in which now, it would seem, an attempt is being made to off-load shares.

Also the following, from the London Daily Mail of Dec. 6 and 13, 1899:

FINANCIAL SCANDALS.

There are many movements in the automobile world at present, of some of which we are likely to hear a good deal when, in the inevitable course of events, the whole history of motor car finance is dragged before the public in the law courts. Despite the company promoting revelations of the last two or three years, despite the intentions of our judges and the press to put an end to the financial scandals of this description, there is a recrudescence of the worst elements of motor car finance now in progress. We are to have, it is said, a further exploitation of bogus patents, and shortly, it is rumored, there will be another attempt to rehash them and force them on the public. My notes of last week brought in many letters from people who have suffered severely, and from some who had been ruined by their participation in the obvious swindles that have so often been worked off in connection with this unfortunate industry.

THE TRADE "RING."

The attempt to form a trade "ring" for the maintenance of prices, and the formation of a kind of trust, is not at all likely to prove even a paper success. It was distinctly unfortunate that one or two respectable motor car firms were represented at its last meeting; particularly unfortunate, because it calls to mind unpleasant passages in the report of committee of investigation into the affairs of one of these companies, which we propose to print at length in due course. That report contains charges of a more than unpleasant character. Manufacturers of motor cars who have got a good article to sell have no need of any such combination. Those who are terrorized into acquiescence by fear of patents need have no such fears. It is a fact that numbers of influential users of motor cars in England which distinctly contravene these alleged patents have challenged those who are supposed to control them, and it is significant that up to the present moment no influential user has been proceeded against. Immediately such proceedings are taken the whole question will be contested. I will deal with the matter further next week. Meanwhile, I shall be glad to hear from further readers who have lost money in motor car companies. I have to thank several Stock Exchange and other correspondents for the information they have sent me with regard to dark passages in the history of some of these concerns.

Mr. Lawson, a curious figure in motor car finance, of whom the public will yet hear much, has returned from America full of schemes for what he doubtless claims to be the advancement of the true interests of automobilism. On his return he issued to certain automobile manufacturers and agents (not to all, nor to the Press), an invitation—headed, "Orders for Motor Cars"—to lunch with him at the Hotel Metropole. An invitation to lunch or dine with the well-known promoter usually indicates business to follow, often a new company.

The manufacturers and agents, after lunch, were informed by the promoter that he proposed to form a union of manufacturers, the main object of which was to be to keep up the price of motor vehicles, to insist upon the payment of one-third deposit on placing orders, and to protect alleged patents owned by Mr. Lawson's companies.

TO MAINTAIN PRICES.

Such proposals, one can well imagine, would meet with ready acceptance from the humbler class of manufacturers. But it is difficult to imagine that any company with self-respect would listen to such a suggestion, seeing by whom it was made. Take the case of the Daimler Co., for instance. Mr. Lawson and his group, having obtained the British rights of the alleged Daimler patent, required £40,000 in cash from the Daimler Co. for the right to manufacture Daimler motor cars. It follows, then, that the public who purchase Daimler motor cars are paying, in addition to the cost of the car and the makers' profit, a proportion of the £40,000 which was paid to the Lawsonites.

Mr. Lawson's suggestion is that the Daimler Co. should join with him and others in keeping up the prices required of the public for the purchase of the car. If the Daimler Co. is making a good car, as I believe it now is, it will have no difficulty in getting a good price for it, and it will receive encouragement and support from a number of people in this country who wish to see the British at the top of the tree in the motor industry. The same remarks apply to the Motor Mfg. and other companies. But if the directors of these companies are so week-kneed and suicidal as to permit their companies to be connected in any form whatever with Mr. Lawson and the group who are associating themselves with him, they will lose the support of their warmest adherents and encourage foreign competition.

DEPOSIT SYSTEM.

No one will object to pay a one-third deposit with his order to a firm which is producing reliable vehicles. Why, then, should any union be necessary for this purpose, unless, indeed, it be to perpetuate the system employed by a companion of Mr. Lawson, of whom, if reports be true, we may hear more in connection with this much-abused deposit system.

It is an undoubted fact that many people paid deposits to this man; few, if any of them, received cars in return; none of the cars were good for anything except the scrap heap; and only those who early in the day insisted upon the return of their deposit succeeded in seeing their money back again without considerable trouble.

It is for this reason that I continually insist on the necessity of the public refusing to pay a penny toward the purchase of a car until the seller can show an official certificate from the Automobile Club of Great Britain of its reliability.

THE RESULTS OF THE PROPOSED "RING."

The effect of any attempt by combine to procure from the public a price for motor cars which could only be obtained by a "ring" of manufacturers could have but one result, viz., the opening of the market to the French and Americans. Any one who has inquired into the matter knows that the alleged Lawsonian patents could not prevent the introduction into this country of carriages which could compete successfully as regards excellence with the English made carriages; and could be sold at prices far lower than even those at present asked by British manufacturers.

The adhesion of the principal firms to Mr. Lawson's scheme would have the effect of estranging men and journals, including the Daily Mail, who, while they have no financial interest in automobile concerns, have striven hard to encourage British manufacturers. These men would not for a moment permit their names to be associated even as supporters of a company which had associated itself with Mr. Lawson.

THE "RING."

The Daily Mail intends to publish for the information of its readers a list of the firms who join, and a list of the firms who do not join, Mr. Lawson's union.

It will give its heartiest support to the firms who, while producing good vehicles, show sufficient backbone to resist the appeals of Mr. Lawson and the cycle company promoters who are working with him. I can scarcely believe that some of the companies whose directors have been weak enough to

consent to serve on Mr. Lawson's committee will, after consideration, agree to be led by the nose by the Lawsonian group. In fact, already I hear that one at least of the companies represented on the committee of the proposed union has, on second thought, decided to withdraw from the union. Of the forthcoming attempt to promote another motor company, we shall speak shortly, and plainly.

* * * * * * * * *

PROMOTERS' PROCESSION.

The so-called Motor Car "Club" advertises, in the space otherwise specially reserved for the advertisements of Mr. H. J. Lawson's company—the British Motor Co., Ltd.—a run to Brighton for Nov. 13, and invites automobilists to take part in it, and a banquet which is to follow. The banquets of the Motor Car Club have often been forerunners of the flotation of such disastrous companies as the Great Horseless Co. We may therefore expect to see, on Nov. 13, a very interesting procession of company promoters and their puppets. Doubtless the shareholders in Mr. Lawson's companies will turn out in crowds to see Mr. Lawson's colleagues.

UNPLEASANT FACTS.

The Daily Mail will gladly support any bona-fide independent motor club. But it cannot permit ladies and gentlemen to be misled into the idea that in dealing with the Motor Car Club they are treating with a club, when in reality it is a company promoting organization, which has been connected with some very disreputable finance.

Mr. Ernest Boothroyd, chartered accountant and auditor, in certifying the accounts of the British Motor Syndicate from Nov. 21, 1896, to Sept. 30, 1897, wrote: "Payments in relation to the Motor Car Club, amounting to £4,378 8s. 2d., have been charged in the accounts as an expense." And similarly in the accounts of the British Motor Co., Ltd., for 1898, he writes: "Payments in relation to the Motor Car Club, £2,222 12s." In the face of this statement, however, the honorable secretary of the Motor Car Club writes that the club is absolutely a bona-fide club, and favors no particular motor, person or company.

A WARNING.

The Motor Car "Club" claims to be controlled by a committee elected by a ballot of the members. But it does not publish a list of this committee, and I am sure it could not publish how many members there were on the "club" books who had paid their subscription for the current year at the time the ballot took place.

The above excerpts will throw some light on the London history of Pennington and Lawson. Lawson's management of his motor car companies was on the "stand and deliver" order. Pennington, the second principal in this unholy alliance, is a notorious mechanical pretender. Prior to his appearance in London in the latter part of 1895 he was concerned in many questionable enterprises in the United States, culminating in his bogus flying machine exhibition and his Kane-Pennington and Racine Motor Vehicle fiascos in Chicago, Ill. His path is strewn with bubbles, wrecks and fakes. Gibbs, another leading figure in the scheme, is a Philadelphian, and a well-known floater of watered stock companies, from which he generally manages to emerge with a life preserver, while those who put the money in go to the bottom. Among his recent creations may be mentioned Gibbs' Alkali and Marsden. He was also concerned in the Lead Cab flotation of unsavory memory. The Anglo-American Co. is a fit companion for the above in the boldness of its conception and the dilute character of its foundation.

"Water, water, everywhere,
Nor dividends to pay!"

There come times in human affairs when patience ceases to be a virtue, and indignation may justly have control. That time has come in the history of the motor vehicle industry in the United States. In regard to the ordinary matters of commerce and of business prudence, honest men may differ; but in regard to the methods of these stock-jobbers, honest men cannot differ. It is robbery, condoned by custom and practiced by the influential and the successful in money making, but none the less, it is what,

"Done with less dainty grace plain folks call theft."

It is a crying evil of the hour in America to-day, a scandal upon the finances of our country and a dark blot on the particular industry in whose growth we are directly interested. In fact, there can be no industry while such harpies as these Anglo-American sharpers, blackened by four years of corrupt financiering abroad, have the daring to invade our shores in quest of further booty. Their coming is an open insult to the intelligence of the American people. Pennington and Lawson are unspeakable.

To meet the situation, it is essential that these freebooters, who have brought disgrace upon the industry abroad and ruin to hundreds of poor investors, should be promptly and effectually silenced. The good name of the industry demands it. Let all who have cast in their lot for the upbuilding of an honest industry unite in some way against these imposters planning to plunder the public in its name. Let the Automobile Club wield its influence in defense of industry and in rebuke of fraud. Let all who stand on the side of justice, public policy and commercial honor declare themselves.

The editor of The Horseless Age calls for a division.

A Word of Warning from Home.

We reprint the following editorial note from the Electrical Review, of New York. It is the first editorial expression on electric vehicles that we have thought worth quoting in any American electrical journal:

A word of warning to the makers of automobiles, concerning the representations made by some of their salesmen, is timely. The automobile industry is very young, and it needs all the support and encouragement it can get. The best way to make the automobile popular is to tell the truth about it. For a maker of electromobiles, for example, to allow his agents to claim impossible performances for his vehicles results inevitably in dissatisfied purchasers. That this practice is not uncommon has been asserted frequently of late. The automobile should not invite the wrath of its prospective friend by misrepresentations. At this particular

time their effect will be worse than at any other, and, aside from all ethical considerations, the commonest business policy dictates strict accuracy in stating its qualities and performances.

Common sense is beginning to prevail, and our electrical friends can now look ahead and see the Nemesis that is coming.

Storage Battery Tests of the Automobile Club of France.

Lead Cab promoters will find it hard to digest the report of the storage battery tests held by the Automobile Club of France last year. According to the terms of the competition, each contestant had to submit five cells, the total weight of which in the box was not to exceed 242 lbs.; the capacity had to be 120 ampere-hours; the batteries were disqualified when the voltage fell below 1.7 volts per cell. The discharge was made irregular in order to approximate conditions in practice, so that the results may be regarded as indicating in how far batteries of to-day meet the practical requirements for motor vehicle work. In L'Electricien M. Bainville publishes a series of articles, in which he gives the results of these tests in tables showing the condition of the batteries from month to month. In the last article, in which he deals with the test during October, he also gives a brief summary. The chief result was that in October the batteries which had proved satisfactory up to that time, failed. In fact, at the end of October, all the batteries which had entered the tests at the beginning of the competition had either failed entirely or had been withdrawn from the competition several times. The only battery which survived had not entered the test until after the eighteenth discharge. He therefore draws the conclusion that for automobile work the life of the batteries at present to be had is not more than six months, and that after this period expensive repairs become necessary. He calls attention to the fact that these results were obtained with the best types of batteries, of strong construction, of a capacity relatively high for the required rate of discharge, and of considerable weight, and the life of some of the batteries tested could have been prolonged somewhat if the manufacturers had taken better care of them during the test. Some of the batteries, however, stood the tests only as long as they were being taken care of by the manufacturers to an extent which would be impossible in ordinary practice.

No Stock For Sale.

The Anglo-American promoters have no stock for sale. Oh no! They are too busy making carriages for the foreign trade to bother about a little matter of $75,000,000 worth of stock. This reminds us of the old rhyme:

"The Devil was sick,
The Devil a monk would be;
The Devil got well,
The devil a monk was he."

The promoters are sick now, and they are assuming an injured air before the public.

Helical Gears.

The helical gears, the advantages of which for motor vehicles were set forth in The Horseless Age of September, 1896, are now coming into use. A well-known manufacturer of special gears recently informed the editor that he had received a number of orders for such gears of double helical, or herring bone, design, and that it seemed probable they would be generally adopted for certain classes of motor vehicle work on account of their noiselessness, durability and economy of power. The advantages are fully stated on page 18 of the issue above referred to, and any of our readers who are sufficiently interested may refresh their memories from that source.

Warning.

Evidence has reached the editor that quite a number of concerns of questionable standing are advertising in country newspapers in order to sell stock through the agency scheme, a favorite method with swindlers of this class. We issue a general warning and advise investigation in every case where such advertisements are used. There are comparatively few legitimate companies prepared to turn out practical motor vehicles in the United States to-day, and these are not adopting such methods of introducing their vehicles.

Promoters Washing Dirty Linen.

Thos. J. Montgomery, of New York, has brought suit in equity against the General Carriage Co., the $20,000,000 New Jersey corporation organized last May to run motor cabs and 'buses in all the large cities of New York State. He claims that he is entitled to $1,000,000 of the company's stock and $300,000 in money which was promised him on May 3, 1899, when he transferred to Joseph H. Hoadley, the promoter and now the holder of $5,000,000 worth of the corporation's stock, rights for the territory within a radius of 25 miles from the New York City Hall, in the patent issued July 26, 1898, for improvements in electric vehicles, to Louis Krieger, of Paris, France. The stock and cash, he claims, have never been turned over to him.

Walter K. Freeman's Auto-Acetylene Swindle.

Walter K. Freeman, the auto-acetylene swindler, Park Row Building, New York, has returned to New York. A detective employed by the parties whom he swindled traced him to Washington, D. C., after a four weeks' hunt, and brought him back to the city. He was compelled to restore some of his stealings, rather than go to jail, and was then allowed to go free.

The alleged business which he conducted under the name of the Auto-Acetylene Co. was a fraud. The stories which he told to parties whom he was endeavoring to interest in his scheme would do credit to a Munchausen. Without unnecessarily multiplying examples, he said he had invented an acetylene motor while in Paris; that he had built it in a shop adjoining the shop of G. Dore, in Levallois-Perret, a suburb of Paris, and that M. Dore had done some of the work for him. He exhibited a motor, which he said was invented by himself, when it was none other than the gasoline motor of M. Dore. He told great stories about the races he had won with his motor in Paris and boasted of his knowledge of gas engines, when several competent withnesses testify that he did not even know how to start the Dore motor. He undertook to design a motor with the assistance of a practical draughtsman, but the result was merely a copy of the Dore motor.

Sometimes he would vary his story out of the fertility of his imagination. He would claim that he owned the Dore patents on gasoline motors for the United States, or that he was the superintendent of the electrical exhibit at the Paris Exposition in the employ of the United States Government, and was soon to return to Paris to act in that capacity. When his time was ripe he did leave, ostensibly for Paris, after having relieved the machinist in whose shop he had been carrying on experimental work of about $500.

He advertised that he had two factories, when he had none, and published in his advertisements a picture of a Dore gasoline carriage, representing it to be one of his new acetylene vehicles. The editor of The Horseless Age is also reliably informed that through his advertisements he actually received checks in part payment for acetylene carriages, which he did not know how to build and had no facilities for building.

Freeman has a crooked career. He has been implicated in many swindles and has served a term in the Sing Sing penitentiary.

Good Roads Meeting.

At a meeting of the Automobile Club of America, held last Saturday at the Waldorf-Astoria, the subject was good roads. Acting President Geo. F. Chamberlain presided.

Addresses were made by Gen. Roy Stone, of Washington; E. G. Harrison, of the office of Road Inquiry of the Department of Agriculture; Edward A. Bond, Chief Engineer of this State; Henry I. Budd, Commissioner of Public Roads of New Jersey, and Thomas C. Mendenhall, of the Massachusetts Highway Commission.

It was decided to urge upon the State Legislature the importance of making more liberal appropriations for improving the highways. It was pointed out that while New Jersey has spent $2,147,478 in improving highways, and Massachusetts $2,637,300, New York State has appropriated only $50,000 a year for two years.

General Stone urged the importance of building a great national highway from Washington to San Francisco, with branches extending to the principal coast cities on each side of the continent.

MINOR MENTION.

The Kensington Bicycle Co., Buffalo, N. Y., will erect a factory in that city for the manufacture of electric carriages.

Albert J. Bostwick, chairman of the Committee on Runs and Tours of the Automobile Club of America, is planning an excursion to Philadelphia.

The Keating Wheel Co., Middletown, Conn., are preparing to engage extensively in the manufacture of electric vehicles for both delivery and pleasure use.

Postmaster Merritt, Washington, D. C., recently tested a Locomobile for the collection of mails, effecting a saving of half the time over the ordinary method.

Representative Sullivan, of Boston, has introduced a bill in the Massachusetts Legislature to require all motor vehicles operated in the city of Boston to carry fenders.

The Altham International Motor Co., Boston, Mass., has secured record title to $6,000 worth of real estate at Fall River, Mass., and to the motor patents of Geo. J. Altham.

Monroe Seiberling, the leading spirit in the Peoria, Ill., motor vehicle manufacturing enterprise, is about to incorporate a company, with $150,000 capital, to manufacture the C. E. Duryea wagon, which they have been perfecting for some time past.

Mrs. Kate Armitage, who was injured in a collision on Jan. 17 between a cab of the Illinois Electric Vehicle Transportation Co. and a carriage in which she was driving, has sued for $20,000 damages. The plaintiff claims the cab was running at excessive speed.

It is reported that John Post, president of the National Light & Power Co., of New York, has recently visited Pittsburg, Pa., with the object of securing a location for a plant for the manufacture of steam and electric vehicles. Mr. Post is the inventor of a storage battery.

One of the Cleveland (O.) Councilmen has introduced an ordinance requiring automobiles to carry two lamps at night, and to ring a bell both day and night when 100 ft. from street crossings. Speed is limited to 12 miles an hour, and a penalty of not more than $50 is to follow violations.

The Cleveland Automobile Club has elected the following officers: E. L. Strong, president; Geo. L. Weiss, vice-president; W. T. White, treasurer, and L. H. Rogers, secretary. Committees were appointed, and measures for the regulation of the speed of automobiles were suggested.

The Ferracute Machine Co., of Bridgeton, N. J., has shipped a carload of 14 presses to the Paris Exposition, and will soon ship another carload. Part will be placed in their space in the main exposition building, and the rest in the machinery annex, or specially constructed American machine shop, which was first suggested by Fred F. Smith, of the Ferracute Co., and was unanimously adopted by the American machinery exhibitors.

Electric Ignition.

WHAT OUR INVENTORS HAVE BEEN DOING.

The engineer, pushing the boundaries of our knowledge into an undeveloped art, has seemed to me like the prospector exploring a mining country. Theory is his compass, or divining rod, and the patent laws define the boundaries of his claims.

The art pertaining to the self-propelled vehicle seems, as yet, to have been but lightly touched, and it presents to successful enterprise the sure promise of riches greater than those of the Klondike.

They say that in this art Europe is excelling us for almost the first time. Why is this? Surely we are not becoming so degenerate as a people as to permit the sneers of the pseudo-practical to break the hearts of our young men.

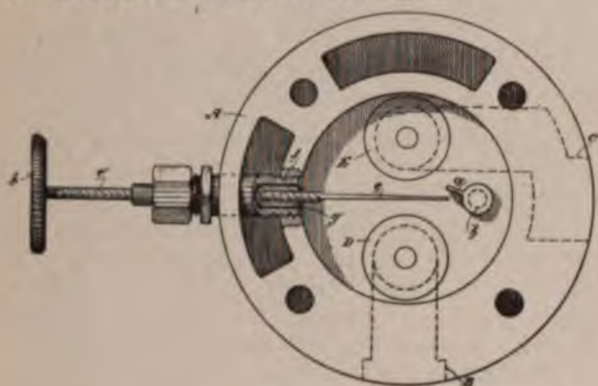


FIG. 1.

I propose in this article to roughly sketch the work that our inventors have done in relation to electric ignition for gas engines. I have had the advantage of the use of the digest of United States patents that Messrs. Parker & Burton, of Detroit, have been 17 years in preparing, at an expense of some $10,000, which, now practically complete, is incomparably the best instrument in existence for making a preliminary examination as to the novelty of an invention, or the state of an art. For instance, in one class alone they have over 900 patents that are now out of print and cannot be obtained.

By order No. 1,189, dated March 8, 1898, the Commissioner of Patents established the sub-class of Sparkers in Class 123—Air and Gas Engines, Explosive.

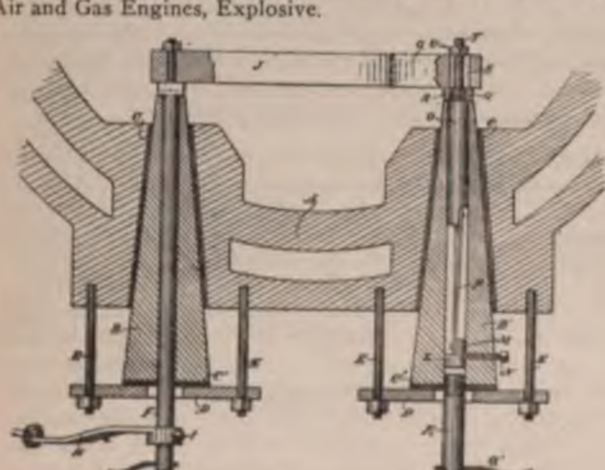


FIG. 2.

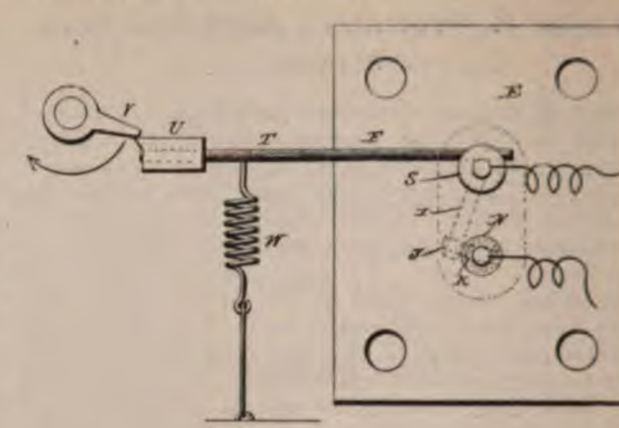


FIG. 3.

There are now about 86 patents in that sub-class, of which two are out of print.

The primary self induction method seems to be receiving the most attention, although there are quite a number of patents showing devices in which the "jump spark" is used.

Induction by a permanent magnet is occasionally shown, and quite a few are magneto and dynamo machines.

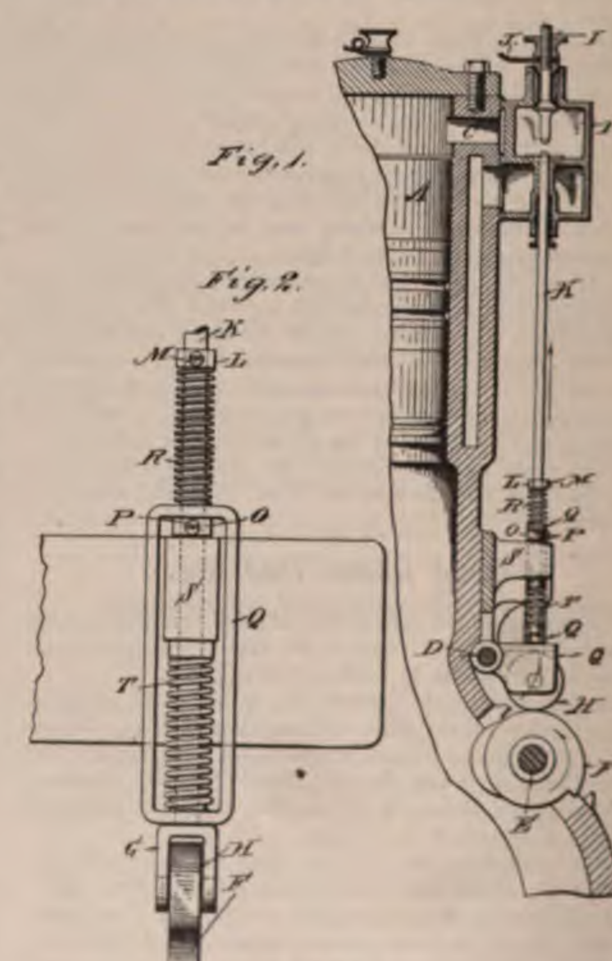


FIG. 4.

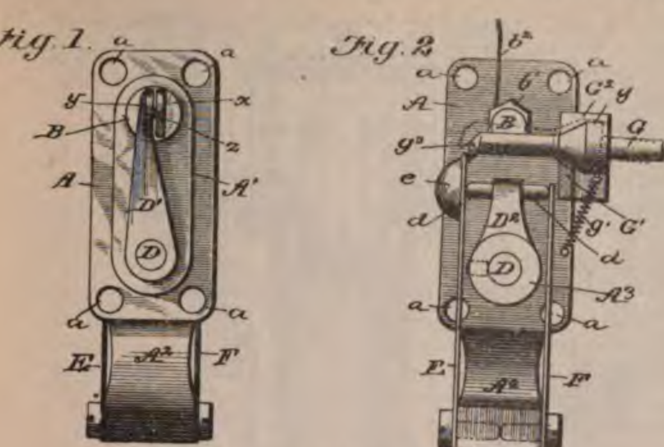


FIG. 5.

PRIMARY SELF INDUCTION APPARATUS.

The most obvious form of make and break contact seems to be that of a spring electrode striking and passing a fixed electrode in the combustion chamber. Some practical men have thought that the spring would be sufficiently durable, even if it was exposed to the intense heat of the burning gases. The object of many inventors has, however, been to get the spring outside the cylinder and still obtain a sharp break of the circuit within the cylinder, the idea being that the spring would not be durable if exposed to the intense heat of the combustion chamber.

Daniel Best, Oct. 18, 1892, No. 484,727, and J. W. Raymond, Dec. 20, 1892, No. 488,483, for instance, use a spring in the combustion chamber. It may be significant, however, that the latter makes provision for a quick and easy renewal of the spring without altering the other parts.

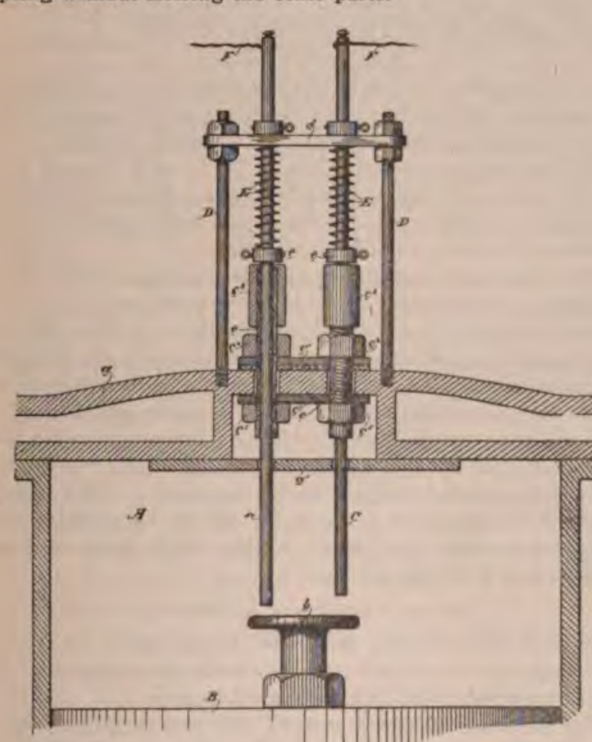


FIG. 6.

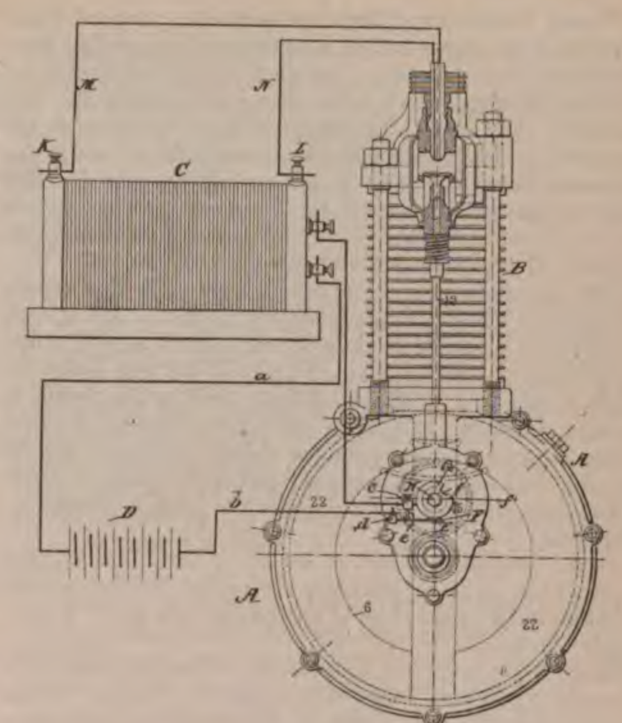


FIG. 7.

Fig. 1 is taken from Fig. 3 of the Raymond patent. e is an elastic spring electrode. It may be screwed out of its socket and replaced by another. The shaft b continually rotates, and the arm a comes into contact with e, to make the circuit, and passes e, to break the circuit.

Mr. Best seems to have been persuaded that it was better to keep the spring outside, as he patented a device having this end in view May 2, 1893, illustrated in Fig. 2. P is a torsional spring outside the combustion chamber, adapted to actuate the electrode Q as the oscillating electrode J passes it. Of course the parts J and Q are in the combustion chamber.

Mr. J. W. Raymond also patented a device with the actuating spring outside, June 1, 1897.

Not only has it been thought desirable to keep the spring outside, but several devices have been patented having for their object the keeping of the inelastic electrodes cool. For instance, F. E. Culver, Feb. 22, 1898, shows a device in which the water jacket extends into the lectrodes in the combustion chamber. C. W. Baldwin, Nov. 16, 1886, and M. M. Barrett, May 12, 1891, among others, also make special effort to keep the electrodes cool.

THE BREAKING OF THE CIRCUIT.

The importance of breaking the circuit quickly has been recognized by several ingenious inventors. Fig. 3 is a reproduction of the second figure of patent No. 292,178, granted to A. K. Rider, Jan. 22, 1884. The part V rotates continuously in the direction of the arrow, which I have added to the drawing. When the part V strikes the part U it bends the resilient arm T and brings the electrodes J K together inside of the cylinder, thus "making" the circuit. When V has passed U the arm J springs back, carrying the heavy piece U with it, which, by reason of its inertia, turns the shaft S so as to separate the electrodes J K and cause the igniting spark. The spring W is simply to deaden the vibration.

Messrs. Weinman and Euchenhofer patented a typical device April 16, 1895, shown in Fig. 4, in which I is one of the electrodes and K is the other. The electrode K is adapted to reciprocate longitudinally. L and P are collars upon the electrode K. Q is a yoke, the upper end of which surrounds and is adapted to reciprocate upon the electrode K. R is a spring pressing against the collar L and against the yoke Q. The yoke Q rests upon the collar P. T is a spring acting against the lug S and against the yoke Q. F is a cam actuated by the engine and adapted to intermittently raise the yoke Q.

The operation of the device is as follows: The cam presses the yoke Q upward, compressing the springs T and R, and, through the spring R, pressing the electrode K against I, thus "making" the circuit. When the step in the cam passes the yoke b, said yoke is driven suddenly down by the spring T, striking a hammer blow upon the collar P, driving the electrode K down and breaking the contact between I and K. By this device a yielding contact that is not likely to injure the contact surfaces of the electrodes and a quick "break" are obtained.

F. M. Spaulding's device, patent No. 562,673, June 23, 1896, works upon the same principle, except that the inertia piece corresponding to the yoke Q has a rotary instead of a rectilinear movement.

Many devices break the circuit by a hammer blow. The hammer is generally drawn back against the force of a spring and released to come against one of the electrodes and knock it away from the other. The patent to Mr. Henry S. Dosh, July 13, 1897, shown in Fig. 5, will serve as an illustration of this type. E is a spring arm, and e is a weight on the end thereof. D is a shaft extending through the cylinder wall. D^1 is an arm on the inner end of the shaft D, having one of the electrodes on its end. D^2 is an arm on the outer end of the shaft D.

The weight e is pressed back against the action of the spring arm and is then released, striking a blow against the free end of arm D^2, turning the shaft D and separating the electrodes.

This device shows and describes a rather startling novelty in the shape of two circular disks on the electrodes. These disks come very close together and touch at a point at their centers to make the circuit. Their sudden separation is supposed to produce a sufficient vacuum between them to materially facilitate the passage of the spark.

There are several devices patented in which the electrodes travel in contact for a short distance, and the break is caused by one electrode striking a solid obstruction, while the other continues its motion.

Possibly the device shown by Messrs. Tremper and Eisenhuth, June 16, 1891, may serve well to illustrate the principle of these devices. It is represented in Fig. 6. A projection, b, from the piston strikes the electrodes c c near the inner dead center of the piston and presses said electrodes up against the action of the springs E E. When the piston commences to move forward the electrodes, impelled by said springs, follow it up until the collars e e strike against the stationary lugs c^2, when the movement of the electrodes c c is arrested, the circuit broken and the spark, or arc, produced.

There would seem to be an objection to this form of lighter, due to its negative lead. However, the writer has seen good results produced by a device working upon this principle.

It is only for a very short distance that we wish a quick movement in the separation of the electrodes, and the solid shoulders would seem well adapted to produce a quick break, and, practically, they seem to do so.

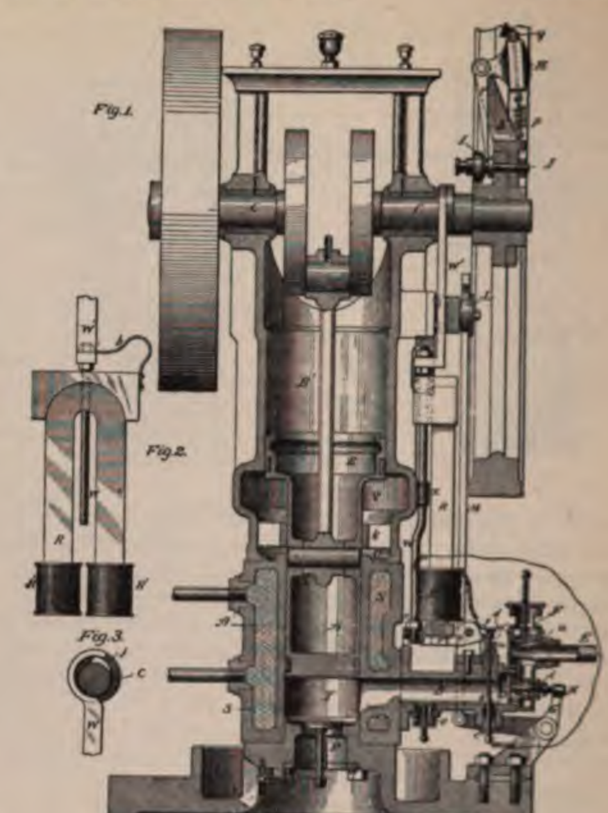


FIG. 8.

There are several patents or devices for rubbing the electrodes together to get a good electrical contact.

THE JUMP SPARK.

The very earliest patent in this sub-class shows an apparatus of this kind, devised by Oscar Hammel, dated June 18, 1867. The next patent in the sub-class was issued 13 years later.

Fig. 7 is taken from the patent to De Dion & Bouton, No. 593,877, Nov. 16, 1897. These gentlemen do away with the troublesome vibrator, as do others, and make and break the primary circuit by a rotary contact piece.

The writer has obtained very good results with a single make and break of the primary circuit to a Ruhmkorff coil.

The feature of this patent is contained in the notched disk G. A spring, E, is held away from the contact point e as long as its end rests upon the periphery of the disk. When the end of said spring enters the notch f contact is made with the point e, completing the primary circuit. As the notch passes the spring is again lifted, breaking the primary circuit and inducing the high tension current in the secondary. If the engine runs too fast the notch will pass the end of the spring before it has time to make the contact, so that this apparatus will act as a governor for the engine.

MAGNETO INDUCTION APPARATUS.

We will pass over the devices for changing the gearing of the magneto or dynamo machines, after the engine has attained its speed, as of little theoretical interest.

Fig. 8 is from the patent granted to Hiram S. Maxim, April 8, 1884, No. 296,341. a^1 b^1 are the electrodes, the ends of

which are normally in contact in the cylinder. R is a horseshoe magnet, and R' are coils surrounding the ends of the magnet R. S is a movable armature. At the proper time a rod strikes the armature S, separating it quickly from the magnet, breaking the magnetic circuit and generating a current in the coils R', which current passes through the electrodes a' b'. The same movement that separates the armature S from its magnet also separates the electrodes in the cylinders, making a spark in the usual way.

Mr. N. C. Bassett, March 15, 1887, places the magnets upon the rim of the fly wheel, so that they will pass, and induce a current in the stationary coils at the required time.

There are several devices for adjusting the apparatus by hand to make the spark at the required point of the stroke—that is, to adjust the "lead" of the engine.

The electricians seem to have neglected this subject entirely.

LONDON NOTES.

AUTOMOBILES AND THE TRANSVAAL WAR.

London, Jan. 25.

The war with the Boers is bringing out all sorts of suggestions with regard to automobiles. The latest is due to E. H. Clift, a West End builder of motor cars, who suggests the formation of a volunteer motor-cyclists corps. Already there are sufficient motor cyclists in this country to form such a corps, but, I am afraid, in view of our red tape bound war office, it will be some time ere the corps is *un fait accompli.* I should not be surprised, however, to see the suggestion quickly acted upon in France, where there are at least ten motor bicyclists to one in England.

A SHOW AT BIRMINGHAM.

To-day the annual cycle and motor show was opened at Birmingham. The locale is as usual the Bingley Hall, but as showing the trend of affairs in this country, it is noticeable that there is a falling off in the number of cycle exhibits, accompanied by a large increase in the display of automobiles, all the large concerns being represented. In connection with the show, a series of automobile trials on the road is being organized. The trials start on Saturday, the 27th inst., extending to Thursday, Feb. 1. The show closes on Saturday, Feb. 3.

THE DE DION GASOLINE MOTOR PATENT.

The question as to patent rights in the De Dion gasoline motor has been much discussed. The De Dion Co. has hitherto taken no steps to protect its rights, until many had begun to ask the question whether there were any exclusive rights in the engine, and in the meantime a large number of competitive motors on similar general lines have been put on the market. However, the De Dion Co. have at last taken the bull by the horns and have seized a number of infringing motors made by six different concerns, and announce that, having once started, they intend to energetically carry on the campaign against infringers in every country in which they have obtained patent rights.

THE AUTOMOBILE CLUB 1,000-MILE TRIAL.

The arrangements for this extensive trial are proceeding apace. Entries are coming in at a satisfactory rate, and as an indication of the widespread interest that is being taken in the event, it may be stated that entries have been made by two Belgian *chauffeurs*. It is now proposed, if sufficient entries are received, to form a separate category for motor bicycles.

MOTOR TRICYCLE PARTS.

A feature of the trade here is that several concerns are now making a specialty of supplying cycle makers and others with all the necessary parts and fittings to enable them to assemble motor tricycles and quadricycles themselves, and already not a few small concerns are taking advantage of the facilities offered them. Much surprise is expressed here at the slow progress which is being made in America in regard to the adoption of motor tricycles.

EXPERIENCE WITH A BENZ CARRIAGE.

At a meeting of the Camera Club in London on Monday, J. M. Knight, of Farnham, read a paper in which he recounted his experiences with a Benz carriage, extending over 18 months. To begin with, the carriage in question was a second-hand one. During the period named £35 had been spent on it, this, with the exception of new tires, being entirely in additions. The engine itself had cost nothing to maintain. The author stated that his longest single trip was one of 83 miles, but that he had made several runs of 70, 60 and 50 miles, the cost of gasoline working out at ⅝d. (1¼ cent) per mile.

PROGRESS IN GASOLINE VEHICLES IN ENGLAND IN 1899.

Considerable progress has been made during the past year in England in the manufacture and adoption of gasoline motor vehicles, which in point of numbers still lead the way. The two largest concerns—the Daimler Motor Co., Ltd., and the Motor Manufacturing Co., Ltd., have been busily engaged in the production of vehicles of the Panhard type, in which such improvements and modifications have been made as to earn for them an unexcelled reputation. The feature of the year in this branch has, however, been the increased attention devoted to the production of a lighter type of gasoline carriage than the Daimler. Space is not available to mention the whole of the new vehicles which have been introduced, but examples of the type referred to are to be found in the "Princess," "Critchley," Beeston Humber, Marshall, Ivel, Endurance, Lanchester and Blake carriages. The Benz maintains its popularity, an indication of which is to be found in the fact that carriages constructed in this country by several concerns, notable among whom the Star Motor Co., Ltd., of Wolverhampton; the Raglan Cycle Co., of Coventry; the Allard Cycle Co., of Coventry, and Grose, of Northampton. Reference has often been made in this column to the growing popularity of light two-seated voiturettes in France, and it is worthy of mention that British firms are beginning to devote increased attention to this class of vehicles. Of this type the Accles-Turrell, the Osmond, Humber, Progress and the Jackson's Doctor's cars may be mentioned. It is in this class of automobile that I look for considerable development during the next twelve months.

The business and works of the Beeston Motor Co, Coventry, is now being advertised for sale as a going concern.

The latest Coventry cycle-making concern to take up the manufacture of automobiles is the Centaur Cycle Co., Ltd., who are turning their attention to the building of voiturettes.

To Turn the Light on Them.

We quote from the New York Herald of last Saturday:

If plans now being matured by Governor Roosevelt and members of the Legislature do not miscarry, a new departure will be taken by the State of New York this year in the treatment of trusts.

A bill has been prepared by Professor Jenks, of Cornell University, who has been a student of economic questions, and whose address at the recent anti-trust conference in Chicago, received widespread attention. This bill has been the subject of conference between Governor Roosevelt, Professor Jenks, Seth Low, president of Columbia University; Speaker Nixon, Assemblymen Allds, Gherardi, Davis and Cooley, and Senators Higgins, Stranahan, Humphrey and Brown.

There will be some modification of Professor Jenks' bill, but, as finally drafted, it is designed to work a revolution in the attitude of the State toward trusts of long standing and those of recent quotation in Wall Street. It is very largely on the line of Governor Roosevelt's message.

Governor Roosevelt took the ground that the chief abuses arising from trusts were misrepresentation and concealment regarding the true facts of the organization of the enterprise, overcapitalization, unscrupulous promotion, unfair competition, raising of prices and the wielding of increased power over wage earners.

STATE EXAMINATION.

The Governor held that the State had the right to examine thoroughly the workings of great corporations, just as is now done with banks, railroads and insurance companies. The State and the stockholders had the right to know whether the stock of a corporation represented the actual value of plant or brands and good will or exclusive rights, or, if none of these things, what it did represent in addition to water, if anything. So, too, the State and the stockholders were entitled to be informed how much of the stock had been actually bought, how much issued free, to whom, and for what reason. He held that many of the grossest wrongs perpetrated on stockholders and organizers arose from the fact that a large proportion of the stock represented nothing of intrinsic value, and was simply unloaded on the public through false statements.

It is claimed for the bill about to be introduced that it will give as liberal opportunities for incorporating in New York and carrying on business as the laws of New Jersey do, with the exception that the prospectus of any new company which seeks to obtain subscriptions to stock publicly shall set forth in the fullest detail the basis on which the company is organized. This must include information as to how much of the stock is actually paid in, how much is represented by real estate and plant, the nature of the property, what is represented by good will in other corporations purchased, what value is placed on patent rights and improvements controlled, who the real parties in interest are, and where the contract of the promoter can be seen.

REPORTS FOR STOCKHOLDERS.

Provision will also be made for a report of each company to the stockholders. This report shall be most explicit. Nothing bearing upon the prosperity and business of the company shall be withheld. If the corporation is a small one it will be kept within the corporation and sent to the stockholders, so that secrets may not be given away to rivals. If it be a large corporation, which looks to the general public for support, the report will become public property.

These reports will be the result of examinations by an auditor, who will not be controlled by the corporations, but the expenses of the examinations must be borne by the corporations examined. The reports will be filed in the offices of the Secretary of State and Controller.

The present Stock Corporation act will not be repealed, but any concern now incorporated thereunder may avail itself of the new law and reincorporate.

It is argued for this plan that it will be of undoubted benefit to legitimate corporations that rest on a substantial foundation and are not overcapitalized, and have not been floated for the purpose of plundering the public. The stock of many industrial corporations, it is believed, is now selling at much less than its intrinsic value, because the public is not fully informed as to their earning capacities.

AFRAID OF PUBLICITY.

On the other hand, many industrial securities are believed to be selling too high. The public has been hoodwinked. The stock is quoted much higher than it is worth, and the conditions of many of them are such that the promoters do not dare to have even a small block of the stock offered in the open market. These concerns, it is believed, would not dare to avail themselves of the examination that will be offered, while corporations that are legitimate will be glad to do so.

It is the aim of the Governor and his counsellors to make the State examination a certificate of solvency as much to be depended on as the certificate issued by the State to an insurance company. Illegitimate corporations will thus be driven out, they think, and the public will have some guaranty of protection other than the mere word of a promoter.

It is evident that the public, who have been bamboozled by the Wall Street promoters during the past year, are demanding some such legislation as the above. What would become of the Lead Cab Trust and the Anglo-American freebooting scheme if the light of publicity were turned upon them?

Use of Traction Engines in War.

Weather permitting, the half score or so of strong Aldershot traction engines, which have at last been detrained here and at Chievely, will do much toward making General Buller's army compact and mobile. Without them the troops would require an astounding length of ox and mule wagons. The despised ox wagon is slow and sure. Its infallible drawbacks are that it occupies a considerable length of road, requires much guarding with many attendants, and can only be depended upon to haul not more than 600 lbs. Nay, more, if the teams are to carry their own forage, the power of hauling is limited to something like 50 miles.

Were the army entirely dependent upon trek ox wagons, the 1,660 of them, the inconsiderable number for conveying the munitions of this army, would stretch along several miles of road. It will be another affair if the dry weather continues and any great use can be made of the traction engines. They require few attendants, don't jib, and each can easily haul 12 tons. They leisurely descend into spruits, roll across and wheel up stiff, long climbs, like flies walking up a wall.

Tacked on to one of the big guns they should, weather permitting, shift it rapidly from place to place, nor are they quite helpless when the ground has been soaked with rain. Clip irons are attached to the rims of the broad wheels, and these dig into the firmer soil, and the steamer rolls forward, leaving a wake like a ploughed field. On the flat, dry veldt the steamers trip along at a brisk 8 miles an hour.—New York Herald.

Nickel Steel Forgings.

While the use of nickel steel forgings for certain important parts of heavy stationary and marine engines has become quite general, yet only occasionally do we hear of nickel steel being used for locomotive crosshead pins, crank pins, piston rods and driving axles. It is conceded by the best authorities that from nickel steel, properly worked, forgings of such parts can now be made which greatly excel similar forgings of all other materials in elastic strength and in toughness.

Probably the cause for this delayed introduction may be found in the greater cost of nickel steel, the greater cost of working and the comparatively short time this material has been successfully made. Also, until quite recently, an opinion prevailed that steel forgings generally were unreliable. This was due largely to the poor work turned out in the beginning at some of the steel forges, and unfortunately some of these concerns are still at work furnishing material of an inferior grade at unreasonably low prices. However, certain steel forges, by improving facilities and processes, have made a well-deserved reputation for the quality of their high-grade steel forgings, and in this way have done much toward the introduction of this material in machinery construction. While the prejudice against steel forgings is fast disappearing among better informed engineers, there remain a few, especially in the West, who prefer iron to steel on account of "fiber." There seems to be no good reason for this preference, as so-called "fiber" is due to the presence of cinder in the iron, which cannot be a desirable constituent of a forging which depends upon the soundness of its welds to hold it together. The true reason for this preference is likely to be found in the fact that wrought iron will endure all kinds of abuse of work and heat treatment and show no bad effects, while steel is quickly injured by the bad handling of ignorant workmen.

To a user of steel forgings, the details of the various processes used in their manufacture may be matters of interest, but not of great importance. There are, however, some features in connection with the manufacture which, if neglected, affect so greatly the quality and soundness of steel forgings that the purchaser should know of these, so as to better enable him to judge between good work and poor work.

Much useful information on this subject is given in a paper on "Steel Forgings," by Mr. H. F. J. Porter before the Western Society of Engineers, Oct. 7, 1896. The paper deals with the methods and latest practice of the Bethlehem Steel Co. in forging high-grade steel. According to Mr. Porter, such forgings are made from fluid compressed, acid open hearth steel, and are carefully annealed after forging. A steel forging should be made from a steel casting larger than the finished piece, as steel possesses the property of welding to a very limited extent. To get the best results it is necessary to use an ingot twice the diameter of the finished forging to be made from it, in order that the proper amount of work necessary to make it a forging shall enter into the metal during its reduction in size under the press. The ingot also must have from 30 to 50 per cent. extra metal at its top, which is cut off and returned to scrap, as it contains a cavity or "pipe" formed at the top, due to shrinkage, and it also has near the top a central core of impurities. For these reasons, only the lower portion of the ingot is solid and suitable for forging purposes. In the process of forging the pressure should be sufficient and of such a character as to penetrate to the center and cause flowing throughout the mass. This flowing of the metal requires time, and the requisite pressure should be maintained throughout a corresponding period. For this reason powerful hydraulic presses have replaced hammers for this work. Wherever the form and size of forgings will allow of such treatment, they should be made hollow, and may be oil tempered; while this increases the cost of the forging, it greatly increases the physical properties of the metal. Hollow forgings should always be made from solid ingots, the center of which has been removed by boring. Careful annealing should always be insisted upon.

Breakages of crank pins and piston rods of locomotives have caused mechanical men to seek a metal of high elastic limit and elongation, which will successfully resist the severe alternating stresses to which they are subjected. When steel was first substituted for wrought iron in locomotive crank pins, a soft, low carbon steel was generally used approaching iron, as regards physical qualities, and failures due to "fatigue of metal" were almost as frequent as before. The broken pins showed what has been called "a fracture in detail," a general parting of the steel extending inward all around the piece, doubtless produced by the working stresses repeatedly approaching the low elastic limit of the soft steel. The average elastic limit of wrought iron is about 20,000 lbs. per square inch where care is taken in its production. On substituting a higher carbon steel with an elastic limit of 45,000 to 50,000 lbs. per square inch failures were greatly diminished without changing the diameter or shape of the pins. Steel of still higher elastic limit and proportionately greater elongation gives correspondingly better results, and for this reason the use of nickel steel is being recommended.

The following figures are taken from Mr. Porter's paper, which indicate the physical characteristics of various steels used to resist alternating stresses.

Mild steel suitable for connecting rods, where the amount of machine work in finishing is very great, and where there is an ample margin of safety in the design, should contain from 0.20 to 0.25 per cent. of carbon and show in specimens four diameters in length, a tensile strength of not less than 57,000 lbs. per square inch, an elastic limit of not less than 27,000 lbs. per square inch, and an average elongation of 25 per cent.

For the general run of engine forgings, where little machine work is required, it is advisable to use a higher carbon steel, with a tensile strength of about 75,000 lbs. per square inch, and elastic limit of 35,000 lbs. per square inch, together with an average elongation of 20 per cent. in four diameters.

For such parts as crank pins, crosshead pins and parts of machinery subjected to severe alternating stresses and wearing action, a still higher grade of steel is recommended. Such steel should have a tensile strength of about 85,000 lbs. per square inch, an elastic limit of about 40,000 lbs. per square inch, and an elongation of 15 per cent. in four diameters. If such forgings are tempered, the tensile strength will become about 85,000 to 90,000 lbs. per square inch, elastic limit 45,000 to 55,000 lbs. per square inch, and the elongation 15 to 20 per cent. By introducing about 3 per cent. of nickel into steel, a finely granular condition results and a high quality of steel is obtained. By hollow forging and oil tempering nickel steel a material is obtained excelling all others known in elastic strength and toughness. Such forgings were used for the crosshead pins, crank pins and axles of the new Purdue locomotive, Schenectady No. 2, while the piston rods of this engine were of the same material, but forged solid. Test bars

of this material ½ in. in diameter and 2 in. between measuring points showed the following physical characteristics:

Tensile strength ....91,000 lbs. per square inch.
Elastic limit ....57,000 lbs. per square inch.
Elongation ....25.05 per cent.
Contraction ....56.45 per cent.

Without going too deeply into this interesting subject, it would be well to note how the physical characteristics of steel are affected by varying the percentage of nickel. In a paper on "High Grade Steel," before the Detroit Engineering Society, June 19, 1896, Mr. J. C. Danziger states that tests which he has made of nickel steel hardened and annealed showed the following results:

	5¼ per cent. nickel.	27 per cent nickel.
Tensile strength, pounds per square inch	127,000	100,000
Elastic limit, pounds per square inch	117,000	47,000
Elongation, per cent	21	47
Contraction, per cent	61	61

It will be noted how wide a range of qualities is thus obtained. The 27 per cent. nickel steel will not rust even in salt water, and may be bent after nicking without breaking. In general, the lower percentages of nickel raise the tensile strength, elastic limit, extension and contraction of steel and increase the ratio of elastic limit to tensile strength and of contraction to extension.

It is also shown in this paper, by the results of tests, that the addition of nickel greatly increases the hardening effect of steel; the hardening effect in turn raises the tensile strength and the elastic limit, but reduces the extension and contraction so much as to necessitate a partial re-annealing.

For locomotive crank pins, crosshead pins, piston rods and driving axles, there is no doubt that nickel steel is the best material now available. We are informed that one railroad in the West is now experimenting with nickel steel locomotive stay bolts, while another intends to try nickel steel plates in boiler construction.

On account of the care which must be taken during the various processes of manufacture to produce nickel steel forgings of the best quality, it is a matter of the first importance that such high-grade material be purchased, under rigid specifications, from those who are experienced and have proper facilities for doing the work. There seems to be reason to believe that as the properties of this material become better known and appreciated by mechanical men, its adoption will be quite general for such parts of motors and vehicles as are subjected to severe alternating stresses and wearing action.

The Niagara Carriage Motors.

The Niagara Carriage Motors, elsewhere illustrated, constitute a valveless engine, to be operated, as desired, either on the two-cycle or four-cycle principle. To get this result no extra parts are added. A loose collar on the gear shaft, being placed at one end of the shaft, makes the engine run two-cycle. When this collar is placed at the other end of the shaft the motor runs four-cycle. The change can be made permanent or while the engine is running.

The motor, being valveless, the makers claim a reliable compression, without variation, at all stages. The gas and air entering the inclosed base are thoroughly mixed by the rotating of the crank before entering the cylinder.

Lubrication of all the working parts takes place from the supply of oil fed to the inclosed crank case. The double cylinders, running two-cycle, give two impulses to a revolution, and very nearly constant power.

The gas producer on these motors is very simple, consisting of but one or two pieces. Its action is so strong that all grades of gasoline can be used. The liquid gasoline is supplied to this producer direct from the main tank, the quantity being controlled by the motor without the use of needle valves, pumps or other uncertain devices. The gas for the motor is generated just as used, but the mixture is not varied with the varying speed of the motor.

The speed of the motor is controlled by a throttle connected with a varying spark, the combination giving a great range and surety of speed.

The ignition is caused by a spark in the firing chamber at a point where the purest gas enters. The contact produces what is called a drawn spark, and with only a 10-in. spark coil will produce a spark fully ½ in. long, of bright reddish-yellow color, and of such magnitude that it will set off any reasonable grade or mixture of air and gasoline. The action of the points is such that they come together easily without any hammering action. After they come together the pressure increases sufficiently to go through any ordinary grease or oil. In tripping the sparking points separate fully ½ in. and return to rest ⅛ in. from contact. By simply unscrewing the sparking plug, both contacts are open for inspection.

These motors, as well as similar marine type reversing engine, are manufactured in various sizes, single and double, by the Noye Mfg. Co., of Buffalo, N. Y.

The Upton Transmission.

This transmission is especially designed to meet the requirements of connecting the engine (gasoline or steam) to the rear axle of the carriage, and, while neat and compact in form, is said to give a strong and efficient gearing, that will positively do the work, with very little appreciable wear. From the appearance (see advertisement), it will be readily noted that three band brakes and a friction clutch perform the different functions. By compressing the middle brake, the slow speed ahead is obtained. Throwing in the clutch gives the fast speed. A brake applied to the disk containing the clutch furnishes an emergency brake should the ordinary brake fail to operate. A brake applied to the disk farthest from the clutch gives a reverse movement to the sprocket.

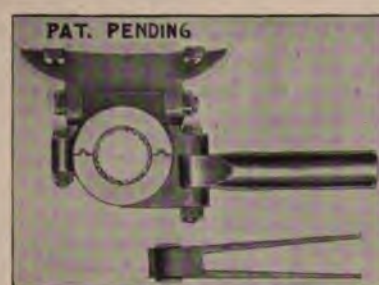
These four movements being all that is required to operate the vehicle, only one lever need be used, but one lever and a foot brake seem most desirable.

The use of the band brake as a friction, in place of the clutch, will appeal to those who have had experience in handling automobiles.

The Borbein Self-Adjusting Spring Bearing.

The Borbein self-adjusting spring bearing is made with a spring block, to receive the carriage spring. This block is provided with four lugs, having holes for two short spring clips, making a fine finish.

The bearing is pivoted between the spring block and the bearing, enabling it to move free and easy with the axle, and dispensing with much friction, when going over any ob-



struction in the road. The bearing is also provided with a reach end, which is also pivoted. The pivot is formed with a solid collar on the reach, which is well fitted into a socket, thus taking all the wear off the bolt.

The top half of the bearing has a round shoulder to take the spring block, which is hollowed out and well fitted over the round shoulder, taking all the wear off this bolt also.

The bearing and rollers are made of the finest cast steel, while the spring block and reach end are made of the best malleable iron, bolted together with machine bolts.

These bearings are made in two sizes, for light and heavy carriages. They are also made for tubing, or wood reaches.

COMMUNICATIONS.

Superheated Steam Engines.

St. Louis, Mo., Jan. 29.

Editor Horseless Age:

Superheated steam produced in heated tubes, or so-called flash boilers, will no doubt force its way to the front, and that, too, in the very near future, by reason of the many and vital advantages which this system and resultant power possess over explosive mixtures and electricity.

To still further increase the efficiency of superheated steam, it has been stated that Mr. Serpollet and Professor Thomson have designed special engines for the most effective use of such superheated steam. Now, if you would kindly publish detailed illustrations and descriptions of the named, or other similar engines, for the use of superheated steam, in your grand journal, which, especially in view of the Steam Boiler and Explosive Motor numbers, I may properly call the encyclopedia of automobilism, you will oblige a large circle of your subscribers. AMICUS.

Another Honest Voice.

Hamilton, Ont., Jan. 31.

Editor Horseless Age:

You have my many thanks and best wishes for the stand you have taken against the Lead Cab and other trusts, and all schemes not intended to advance the best interests of the motor carriage business, and you should have the support of every honest man the world over. Honest labor in this line will eventually win, and if you keep up the battle against all frauds and deceptions, success will come that much sooner, and the victory will be yours. Yours truly,

W. G. WALTON.

OUR FOREIGN EXCHANGES.

Chain Transmission.

In reference to his drive chains, Hans Renold, of Birmingham, England, says in a recent number of the Autocar:

The class of chain in question is my patent silent driving chain, which has been, and still is, so largely used on heavy motor cars. It is there used because it allows of great power transmission with a short pitch, and thereby making a fair speed ratio between large and small wheel possible without the wheels getting too large. This class of chain, when substantial shaft center stays are provided to keep the center distance rigid, and when properly protected from the road mud, has given everywhere satisfaction, and its smooth running has been particularly commented upon. These provisions Mr. Parker has properly met, and, therefore, can speak with such satisfaction as he did, as could also a great many of my other customers who have adopted similar precautions, and allowed ample strength for the work in hand.

Now, Mr. Opperman has made some remarks based upon the experience gained by the late London Electric Cab Co. I am quite ready to admit that my silent chains in that company's service have not given the same satisfactory result; but the reasons are not difficult to explain.

First—There was absolutely no protection from road grit, and, the large wheels being unusually large, the chain was very near to the ground.

Second—Considerable alterations in the motor speeds were made from what they were at the earliest experimental stages, and with these alterations the style of chain and size of wheels should also have been altered. My advice was not taken, and I did not press the change, being assured that the chain was satisfactory, and that other points, such as tires, etc., required their attention for the present much more than the chain gear. I can only wish I had made a firmer stand, and actually refused to supply the silent chain any longer, knowing, as I did, that under the conditions roller chains would give better results in their case.

Third—The chain used was latterly far too weak, as the cabs increased in weight, step by step, until at last they reached 3,500 lbs. and more.

I am afraid I should take up too much of your valuable space if I attempted to explain why, under certain conditions, the roller chain is preferable to my silent chain for light motor car driving. The construction of each chain would have to be described, in order to show why one gives better results under certain conditions than the other, and vice versa.

For light motor cars there can be no doubt that a well-made roller chain is the best, and far preferable to the block chain, which is still so often used. For this reason, I have designed a series of larger sizes, and am preparing machinery to produce them in the same high quality as my ½-in. and ⅝-in. cycle roller chains, which give such satisfactory results. The designing and making of these new manufacturing machines have been in hand for nearly 18 months, as the special metals used bring special difficulties which must be met.

I have every confidence that with these new chains I shall be able to eliminate the chain troubles altogether, which, with the lighter motor vehicles, have so far been always present. I need hardly say that the wheels also must be of correct

construction, accurately cut, and properly mounted. To make also sure of these points, preparations are made to supply correctly constructed tooth wheel cutters to enable manufacturers to cut their own wheels, or for me to cut their blanks.

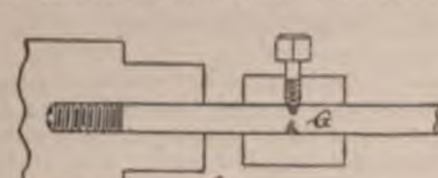
Motor Vehicle Engineering.

TANK WORK.

Motor vehicle machinists are often required to make metal and tank connections for injectors and pumps. Copper of a thicker gauge may generally be used with advantage, being more ductile. Should the reader be unable to obtain his metal in flat sheets ready for use, he will have to prepare it for himself, as that supplied by dealers in rolls is unsuitable. After cutting off a piece somewhat larger than is necessary, it should be annealed by making it red hot all over and then placing it in ashes to cool slowly or when still red hot plunging it into water, a plan adopted by some engineers, but which, when applied to worked pieces, involves the risk of cracking. The metal should be carefully flattened by gently planishing it with a mallet on a flat wood block, commencing in the center and working out to the edges, avoiding as much as possible striking on the same spot. It will often be better to bend the plate as flat as possible and then rub the unevenness out with the head of a large smooth hammer, the plate resting on the flat wood block; and if the metal has been properly softened or annealed it will generally yield to this treatment. But as the metal can be obtained in flat sheets (the copper being known as bright rolled), the reader will do well and save himself no little trouble by using it in this form. To ascertain the tensile strength and other qualities of metal plates, there should be taken from each sheet to be used a test piece 10 inches in length and 2 inches in width. After the coupon has been cut to the proper width it should be carefully measured to ascertain its width and thickness at the smallest part, i. e., that part intended for breaking. It is next put on a testing machine and pulled apart. By noting the strain at which the coupon parted, the tensile strength per square inch is easily computed by the rules given in any engineer's handbook.

CAUSED BY LOOSE CONNECTIONS.

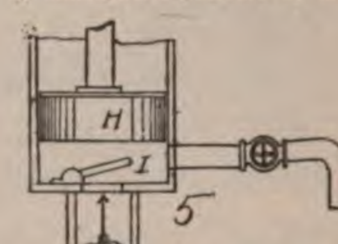
Recently trouble was experienced in getting an equal power on a motor. An examination revealed that the defect was caused by the occasional slipping of a shaft in one of the couplings. Fig. 4 shows this shaft in section. The trouble occurred at G, where the set screw had torn out a



groove along the diameter of the shaft. As soon as a new shaft was substituted the trouble ceased. If a defect of this sort is not remedied, the chances are that the point of the set screw will cut the shaft entirely off for the reason that the set screw will be screwed deeper and deeper into the groove to tighten the connection.

THE LIFT AND FORCE PUMP.

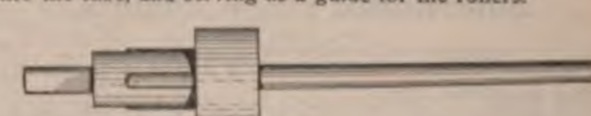
The ordinary design and action of the lift and force pump used in motor service is shown in Fig. 5, in which the oil is raised by atmospheric pressure by means of the



tightly fitting piston, H, which draws the oil up when the piston is lifting. As soon as the piston descends the valve I, closes, and the oil is forced through the side pipe which is joined to the cylinder.

Boiler Tube Expander.

The accompanying sketch shows a little tool which ought to prove very handy for owners of steam carriages. It is a roller tube expander for tightening tubes of boilers that have been burnt out and are leaky. There are three parts—the center pin or driver, which tapers toward the end, three parallel rollers turned by the driver, and the housing for the rollers, having an enlarged head to prevent the tool from penetrating too far into the tube, and serving as a guide for the rollers.



TUBE EXPANDER.

The tool is operated by a T wrench or an ordinary hand brace, and the makers—the Arthur Co., 190 Front St., New York—claim that with it a burnt tube can be tightened in ten or twelve turns. Various sizes are made, that for small boilers of the Locomobile type being 7-16 in.

The Law Department of the city of Chicago is preparing an amendment to the municipal code, requiring owners of public motor vehicles to pay the same license fee as is now collected from owners of horse vehicles in such service.

MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 641,204—Jan. 9, 1900—E. F. Gray, of Cincinnati, O.—Gearing for horseless carriages. The claims of the inventor are well summarized in the two which are here given:

In horseless carriage construction, the combination with a front axle composed of a hollow arched piece and a hollow straight piece connected at their middle by a block having a central transverse opening forming a bearing for the perch, allowing free movement of the axle vertically to allow the wheels to pass over obstructions, of a yoke or saddle for the forward spring composed of a pair of plates so bent as to form a rest for the spring and to pass over the central block and hinge upon it, so as to allow it to swing with the bed, of a pair of vertical bearings at either end of said axle composed of a casing having a cup-shaped opening in the top and bottom thereof, and a stub axle having an upward extension passing through the vertical bearing and carrying a pair of hemispheres within the cup-shaped openings in said bearing and a pair of steel cups interposed between said members with means for taking up wear, a steering rod attached to rearward extensions on said stub axle and having yielding connection with a steering lever.

In a vehicle of the character described, the combination with a motor shaft carrying pinions meshing with pinions on the periphery of friction disks loosely mounted on a countershaft having the other members of the friction clutches fast thereon, with means for throwing the clutches into or out of connection with the friction disks, and means whereby no two of the clutches may be thrown into gear at the same time, consisting of lever mechanism consisting of a pair of slotted arms set at right angles to each other and having an operating lever passed through them at the point of bisection in such manner that when the lever is moved forward or backward it will affect only one of the slotted arms to throw in or out of connection one of a pair of the clutches, and when the said operating lever is moved to either side it will throw in or out one of another pair of friction clutches, and means for locking the operating lever in any of its positions for holding the clutches in gear, of a sprocket wheel fast on the countershaft and connected to a differential gear mounted on the rear axle of the vehicle, consisting of a sprocket wheel driven by the before-mentioned sprocket wheel, and carrying a set of miter wheels meshing constantly with the pair of miter wheels fast on the ends of the rear axles, so as to allow one rear wheel of the vehicle to turn faster than the other in turning a curve, of the coupling pole connecting the front and rear axles and split toward the rear to allow the driving chain to pass therethrough, of a chain tightening wheel mounted on a spring adjustably mounted on the coupling pole, and a brace extending from the lower part of the differential casing forward and upward to the coupling pole and connected thereto by the same bolt that holds the adjustable chain tightener for the purpose of preventing any rotary movement of the differential gear case and for stiffening the construction of the vehicle, of a pair of braces extending from the vertical bearing of the front axle rearward and connected to the coupling pole by a rocking member, so as to provide for the rise and fall of the front axle in passing over an obstruction, and to prevent lateral movement of the said front axle, and another pair of braces extending from the outer ends of the rear axle forward to the coupling pole to prevent lateral movement of the rear axle.

Five claims. Application filed Aug. 24, 1899.

No. 640,968—Jan. 9, 1900—Electric Vehicle.—E. A. Sperry, Cleveland, O.

Fig. 1 of the specification is here given. For lack of space the sheet showing electrical connections is omitted.

The invention relates to an electric vehicle, and it consists in arrangement of the various parts and compartments of the body; and, further, in various devices and accessories and their arrangement within the vehicle designed to render such vehicle complete in its details.

Fig. 1 represents a longitudinal sectional view of the carriage, embodying the improvements.

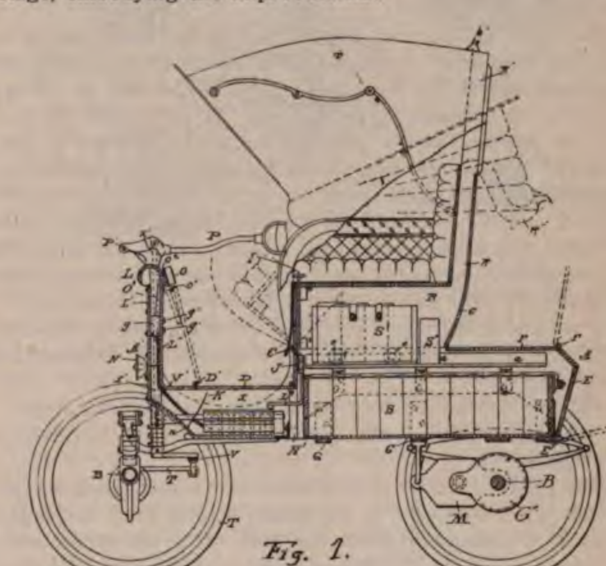


Fig. 1.

The vehicle body A is supported suitably upon the axles B B and wheels, as shown. The body is furnished with a dasher, A′, and a seat, C, may be secured to the body by hinge, C′. The floor of the body is illustrated at D, and may be hinged at D′. The vehicle body is further supplied with a swinging end gate, E, which may be hinged at E′, and an upper panel of the rear extension of the body A, shown at F, and may be hinged at F′. Suitable cross pieces connect the two sides of the body (illustrated by G G), on which the storage batteries or sets of storage batteries S rest. Above these is another pair of storage batteries, S′ and S″, within the space formed by the risers R and back panel C of the seat. These batteries, or some of them, may be characterized by the peculiarity that they generate hydrogen gas, and may form a dangerous and explosive mixture with atmospheric seat. These batteries, or some of them, may be characterized body (shown at a a), and I prefer to extend it rearwardly, as shown, for the purpose of sliding the battery S′ back after the seat has been tipped, as shown in dotted lines. The panel F has been raised to position (also shown in dotted lines), and batteries S″ removed. A ventilating passage, R′, is shown as

extending upwardly from the battery compartment, preferably rearwardly and away from the switch compartment, and may receive a still further upward extension by R'' R'' under the top T° of the vehicle. The dotted line shows the position of this compartment when the top is in a folded position. A rain guard, b, is placed for suitably protecting the top of the passage R''.

It will be seen that the carriage is divided into separate compartments by the partition H'. The contents of the rear compartment having been described, that of the forward compartment will be seen to contain the current-controlling switches and will be seen to be lower and forward of the battery compartment.

A lever arm, L[4], co-operating with the moving parts, for instance, of the switches, is furnished with a handle, I, near the cushions of the seat, and a coupling and uncoupling device near the hinge C' is shown at J. This is of such a character that when the seat is tipped forward the handle I may be disconnected from the lever L, and thereby prevented from bending or otherwise being injured by the forward tipping of the seat upon the hinge C'.

It is well known that electric storage batteries require inspection frequently, and in the construction of cells, which are preferred to use, his inspection should be possible at the top of each cell constituting the battery. It will readily be seen that by tipping the seat forward the upper cells are at once brought to view, and by opening the panel F the rear half or more of the cells upon the lower deck. Now, by sliding the cells S' and S'' backward the forward half of the cells in the lower compartment are readily brought to view and inspected.

The rollers e e may be used to facilitate the moving of the batteries S'. The battery S'' is light and easily removed.

It will be noted that the ventilation is away from the compartment X, containing the current-controlling switches and controller H.

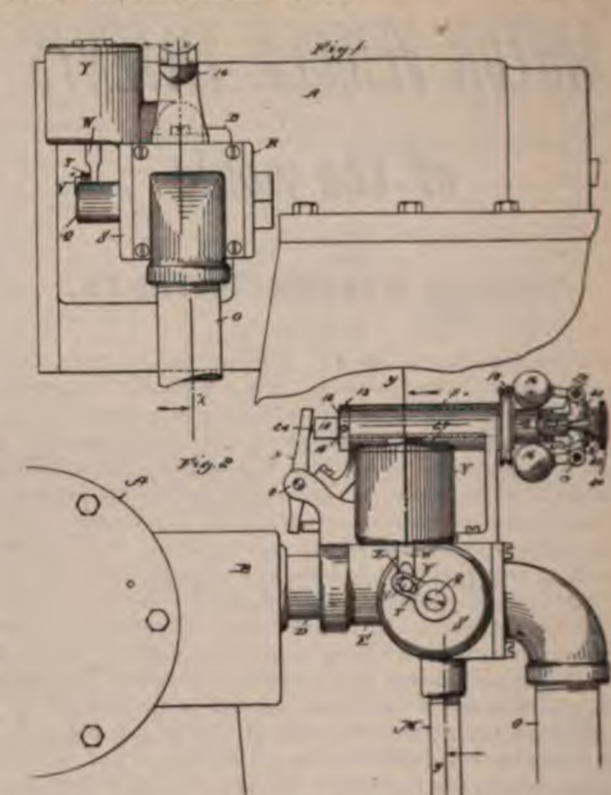
Thirty-four claims. Application filed Aug. 19, 1898.

No. 641,156—Jan. 9, 1900—Gas Engine.—Geo. S. Shaw, of Springfield, O.

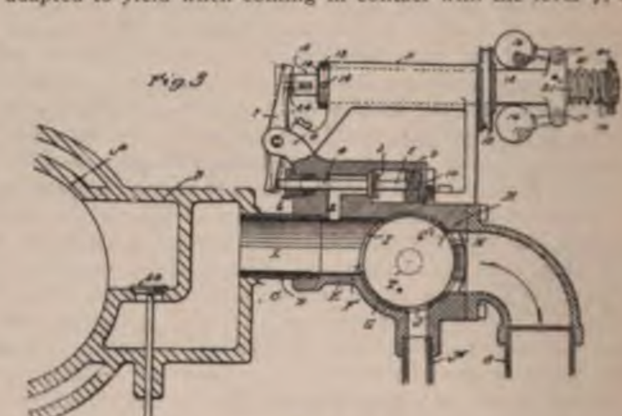
The peculiar feature of this invention is in devising a regulation of the aspiration of the piston so that when the engine exceeds a maximum speed the inlet valve will close, while at the same time the proper ratio of gas, etc., and air will be maintained.

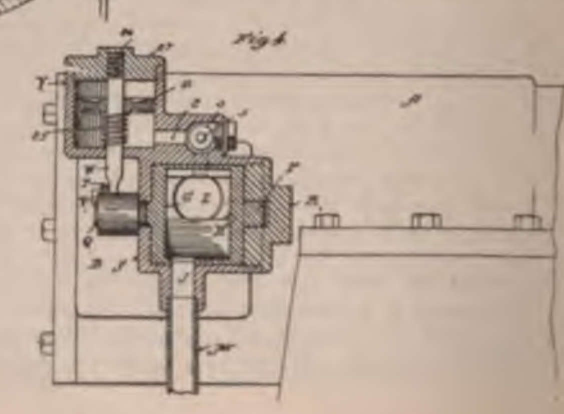
Fig. 1 is a side elevation of a gas engine; Fig. 2, a partial end elevation of the same; Fig. 3, a view on the line x x of Fig 1, and Fig. 4, a view on the line y y of Fig. 2, both looking in the direction of the arrows.

Referring to the governor mechanism and the manner in which the piston in the suction cylinder is operated, the attachment E carries a sleeved bearing, 11, which is adapted to receive a hollow shaft, 12, therein, such shaft being held from pulling out of the sleeve by means of a collar, 13, secured thereto by a set screw, 14, and a pulley, 18, cast or otherwise secured thereto, such collar and pulley being at the respective ends of sleeve. A pair of governor balls, 16, are pivoted to said hollow shaft near its outer end, as shown at 17. Arms, 22, in the nature of bell crank levers, extend from balls and project within notches or recesses, 23, in a shaft, 15, and act to reciprocate shaft in one direction to rock the lever 7 to the dotted line position, as shown in Fig. 3. A tension spring, 21, mounted upon the shaft 15 between a knurled nut, 20, and a washer, 21', acts to return shaft to its outward position when the governor balls are in their normal position. The knurled nut may also be secured more or less on the shaft 15 to regulate the tension of the spring 21, according to the desired



speed of the engine, in a manner well known, it being understood that the governor balls are operated through the pulley 18 by means of a belt or other suitable means. The inner end of the shaft 15 carries a spring bumper, 24, which is adapted to yield when coming in contact with the lever 7, so





as to prevent noise, as might possibly be the case where the shaft 15 itself came in direct contact with the lever.

Let us suppose that the governor balls are placed under the proper tension to remain in their normal in position when the engine is running, say, at a speed of 150 revolutions per minute, and that such speed is being exceeded. This will immediately cause the governor balls to fly outward, which action will shift the shaft longitudinally in its bearings and will throw the upper arm of the lever 7 inward, while its lower arm is thrown outward, as shown in dotted lines in Fig. 3. This action of the lever will cause the valve 3 to be raised from its seat, which will open the passage 2, and consequently the sucking action of the piston in the engine A (not shown) will continue to create more or less of a vacuum in such passage, and as this passage is connected with the suction cylinder a partial vacuum will be formed beneath its piston, which will instantly cause it to descend; but as soon as this occurs the piston stem, which engages with the crank T, rigidly mounted upon the gudgeon Q, projecting from the inlet valve, partially rotates such inlet valve, which more or less closes the gas and air inlet passages simultaneously, thereby diminishing the mixture passing into the engine cylinder. The instant, however, the speed of the engine returns to normal the valve 3 is seated and a spring, 25, again returns the piston Z to its normally raised position, a spring, 26, within the cap 27 of the cylinder Y acting to cushion the upward stroke of the piston, so that there is no pounding or noise due to the piston suddenly assuming its normal position. It will be understood, of course, that this spring is much weaker than the spring 25. This upward movement of the piston Z in the suction cylinder will again partially rotate the inlet valve, so as to again fully open the air and gas or gasoline ports, thereby permitting a normal charge to again enter the engine cylinder.

In order to prevent the explosive charge from passing back through the inlet passage on the compression stroke of the engine piston, a valve, 28, is provided of the ordinary or any approved construction.

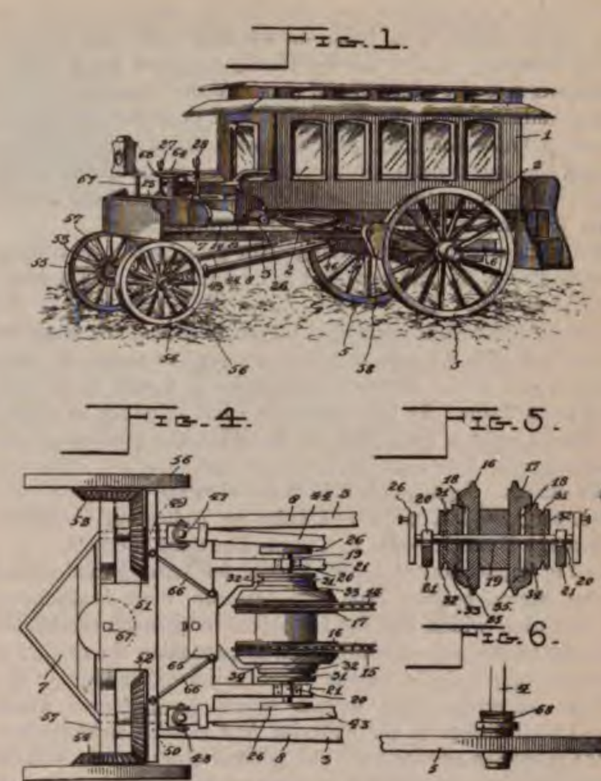
Three claims. Application filed June 5, 1899.

No. 641,043—Jan. 9, 1900—Automobile.—Peter J. A. Schnoar, of Holstein, Iowa.

The object is to simplify and render more effective the gearing mechanism intermediate of the wheels and power, and is more particularly directed to the origination of a simple contrivance for communicating power to the front wheels without interfering with the swinging of the forward truck, which is necessary to the proper guiding of the vehicle.

Referring to the drawings, Fig. 1 is a perspective view of my vehicle or automobile complete. Fig. 4 is a fragmentary plan view of the forward end of my device, with the body and main frame removed. Fig. 5 is a sectional view showing in detail the power shaft, its sprockets, and clutch mechanism; and Fig. 6 is a detail view showing a clutch by means of which one of the rear wheels may be disconnected from its shaft to facilitate turning.

The inventor states that in order to obtain the greatest efficiency in vehicles of this class it is necessary to transmit power to the front shaft, as well as to the rear, and, as premised, therefore invented a simple yet highly efficient form of gearing, by means of which power may be transmitted from the gear drum 9 to the front wheels without interfering with the swinging or swiveling movement of the latter necessary in guiding the vehicle. This device is one of the most important features, and, it will be noted, not only communicates power to the front wheels without interfering with their movement, but is also enabled to drive them in a direction corresponding with the direction of movement of the rear axle.



36 and 37 indicate bevel gears carried by short shafts, 38 and 39, journaled in a frame piece, 40. These gears mesh, as illustrated, with the gears 10 and 11, and their short shafts arranged horizontally, as shown in Fig. 3, are connected by universal joints, 41 and 42, to the telescoping sections 43 and 44 of extensible shafts 45 and 46, connected through universal joints 47 and 48 with horizontal short shafts 49 and 50. Upon these last named shafts are mounted bevel gears 51 and 52, meshing with bevel gears 53 and 54, secured to wheels 55 and 56, carried by a forward axle, 57, but independently mounted thereon. It will now be seen that when the power shaft is actuated the front and rear wheels of the vehicle will be rotated in the same direction, whether forward or backward, and that the power drum 9, being located at the center of the rear axle, and the front wheels, being provided with independent power transmitting mechanism, the power is properly centralized; also, that by means of the clutches 33 and 34 either or both sides of a double-acting motor may be coupled to the power shaft.

The double sprocket gearing permits either member of the double motor to be thrown out of operative relation with the power shaft in order to effect economy in the power required for the propulsion of the vehicle. Telescopic adjustment of the shafts 45 permit the free turning movement of the forward truck without interfering with the operative connection between the front wheels of said truck and the gear drum on the rear axle.

Fig. 6 illustrates a simple form of clutch 68, connecting the rear wheels to the rear shaft, and by means of which one of these wheels may be disconnected from its shaft to prevent the dragging of the rear wheels as the vehicle turns a corner. Any suitable means may be employed in connection with each

clutch 58 for the purpose of adjusting the latter to make its rear wheel fast with or loose on the rear axle; but as such clutch-adjusting means can be readily supplied by a skilled mechanic, it is not necessary to illustrate the adjusting means.

Any suitable brake mechanism may be provided, as, for instance, a brake shaft, 57, provided with brake shoes, 58, engaging the rear wheels, projecting levers, 59, upon the brake shaft, being connected through connecting rods, 60, to the lower extremities of brake levers, 61, as illustrated.

62 indicates a vertical steering shaft journaled in a vertical bearing sleeve, 63, and provided at its upper end with a steering wheel, 64.

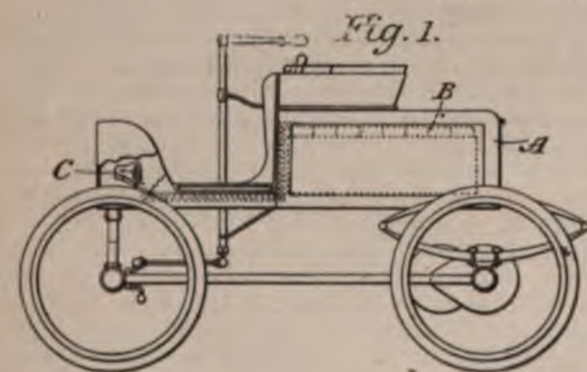
65 indicates a yoke carried at the lower end of the shaft 62, and to the opposite ends of which are pivoted rings, 66, likewise pivoted at the opposite extremities to a part of the forward truck frame. By this means the front axle may be turned as desired upon a king bolt, 67, to effect the guiding of the vehicle.

Six claims. Application filed Sept. 14, 1899.

No. 640,753—Jan. 9, 1900—Device for Indicating Condition of Storage Batteries.—H. F. Cruntz, Hartford, Conn.

In the application of H. P. Maxim for letter patent of the United States, bearing even date herewith, there is disclosed an invention which has for its object to provide means for warning an inexpert operator, and, in particular, the driver, of a motor road vehicle, of the approaching exhaustion of the storage batteries, which furnish power, to a degree which would be injurious to the batteries, and various embodiments of the invention are shown. The general object of the present invention is the same; but it is sought herein to cover an embodiment of the invention in a form which differs from the particular forms illustrated and described in the aforesaid application, and which possesses certain characteristics which commend it particularly under some conditions of use.

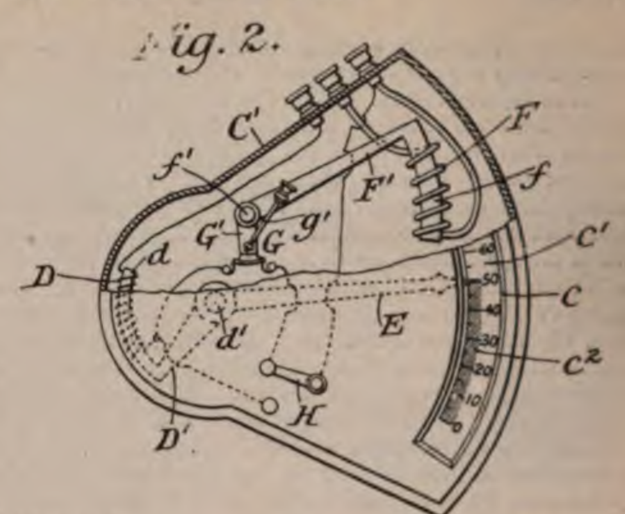
Fig. 1.



The device in which this invention is embodied has but one needle or indicator, which is in view only at such times as the conditions of discharge of the batteries make it desirable that the signaling device should be observed, whereby there is no opportunity for even the most unpracticed observer to be misled.

In the drawings, Fig. 1 is a view in elevation of a motor vehicle which is equipped with the improved signaling device, the dashboard being partly broken out to show the signaling device, while the battery and its connections are represented by dotted lines. Fig. 2 is a plan view of the signaling device, with part of the top plate removed.

Fig. 2.



In Fig. 1 of the drawings the body A of the vehicle is represented as adapted to receive the storage battery B, while the signaling device is conveniently located, as at C, at the forward end of the footboard. A suitable casing, C', incloses and supports the several parts of the signaling device, its top having a slot, c, through which the indicating needle may be seen. The indicating scale c' may be formed upon the glass, which closes the slot, and a portion of the scale, as at c², may be colored or otherwise distinguished from the rest for the purpose of indicating more clearly and unmistakably the danger position of the needle. At D is represented a solenoid, which is so wound as to respond to differences in voltage or potential, its cured core d being carried by an arm, D', which is suitably pivoted at d' and carries the volt meter needle E. A second solenoid, F, wound with heavy wire, so that its operation is determined by the amperage of the current which passes through it, likewise has its curved core f carried by an arm, F', which is pivoted at f'. Both of the solenoids are suitably connected with the battery, the volt solenoid being connected through the contacts of a circuit breaker, G, the movable arm G' of which is carried with the arm F', above referred to. The arm G' is preferably not fixed rigidly to the arm F', but is connected therewith by an adjusting screw, g', which permits the relative position of the arm G' to be varied, as the conditions of use may require. So long as the amperage is normal the circuit through the volt solenoid is closed and the volt meter needle E will stand at some point on the scale c', informing the operator as to the condition of the batteries; but when the amperage is abnormal the volt meter circuit will be broken at G and the volt meter needle will pass out of sight at the end of the scale. Thus, whenever the needle is out of sight the operator need not concern himself as to the condition of the batteries; but when it appears upon the scale and approaches the danger point, the operator will understand that the batteries are being exhausted to a dangerous degree. If it is desired at any time to make the volt meter independent of the abnormal amperage cut out, this can be effected by closing a switch, H, which is included in a shunt around the circuit breaker or cut out G.

Four claims. Application filed Oct. 27, 1899.

No. 640,787—Jan. 9, 1900—Device for Indicating Condition of Storage Batteries.—H. P. Maxim, Hartford, Conn.

This is the patent referred to in the preceding specifications, and several arrangements are shown to attain the same results.

Three claims. Application filed Oct. 27, 1899.

ELECTRIC IGNITION IN GAS, GASOLINE AND OIL ENGINES.

We make special SPARKING POINTS for this service possessing extreme hardness and greater durability than platinum.
SEND FOR DESCRIPTIVE MATTER AND PRICES.

BAKER & CO., Manufacturers of Platinum Products, NEWARK, N. J.

Graphite Lubricants,

ALL KINDS, ACCORDING TO WANTS.

Special preparations for Gears of Electric Motors and for Cylinders of Motor Engines. Send for Circulars and Prices.

Joseph Dixon Crucible Co., - Jersey City, N. J.

BALDWIN DETACHABLE CHAINS

made for Automobiles, in sizes to suit all requirements. Prompt deliveries made. Address:

BALDWIN CYCLE CHAIN CO.,
WORCESTER, MASS., U. S. A.

VOLUME FOUR COMPLETE.

(April 5th to September 27th, 1899, inclusive.)

To New Subscribers for Two Years.

We wish to place these volumes in the hands of persons permanently interested and therefore offer them only to those who will subscribe for two years from April 5th, 1899. :: :: ::

SEND $4 AND GET THIS VOLUME BEFORE IT IS EXHAUSTED.

HIGH GRADE GASOLINE

AUTOMOBILE AND MARINE ENGINES.

THE CHARLES B. KING CO., DETROIT, MICH.

HASBROUCK AUTOMOBILES AND LAUNCHES.

EQUIPPED with The Hasbrouck Motor, the ONLY ABSOLUTELY Odorless Gasoline Engine on the market. We say odorless and we MEAN odorless, and will demonstrate it to any one wishing to investigate. It is NOISELESS and ABSOLUTELY SAFE. Automobiles in Runabout and Surrey styles. Modified Stanhope pattern. Launches from 20 to 50 feet.

ORDER NOW FOR SPRING DELIVERY.

HASBROUCK MOTOR CO., 68 Broad Street, New York.

The Winton Hydro-Carbon.

SIMPLICITY **STRENGTH**

EVERY ARGUMENT IS MADE IN FAVOR OF OUR CARRIAGE.

Leading drivers in America, whose experience with mechanically propelled vehicles place them in position to know, will say that the quartette of virtues possessed by **The Winton** is **simplicity, strength, durability** and **speed**.

It is always comforting to enjoy the perfect ease and luxury of locomotion afforded by The Winton Hydro-Carbon System Carriage. It is the carriage for all occasions during the four seasons. . . . .

Early orders are assured of prompt delivery, but in a short while the "waiting list" will be exasperatingly long and you will have to suffer much inconvenience in securing delivery.

....SEND FOR CATALOG....

DURABILITY **SPEED**

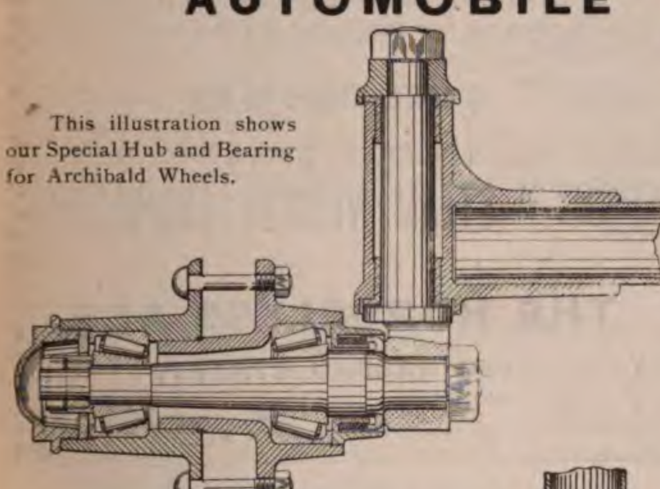
The Winton Motor Carriage Co.

CLEVELAND, O., U. S. A.

Eastern Office, 120 Broadway, New York City.

AUTOMOBILE ACCESSORIES.

This illustration shows our Special Hub and Bearing for Archibald Wheels.



GUIDING HINGE : : :

Our Hinge is made from the best of steel. Used with either style of Grant bearings to suit wheels.

REAR AXLE BEARINGS

FOR DIFFERENTIAL DRIVE.

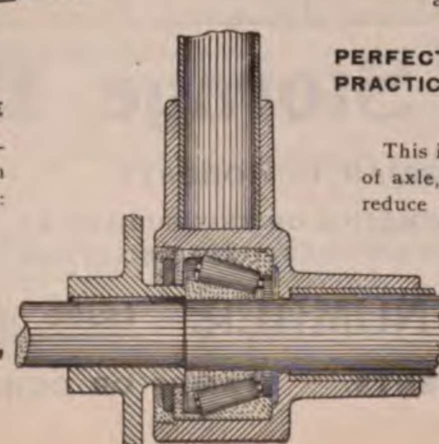
This style bearing forms the rear corner pieces for frame upon which the springs are fastened.

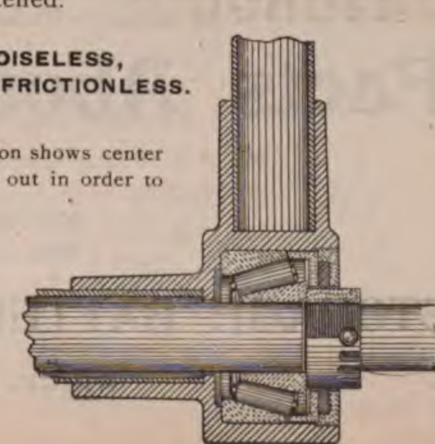
PERFECTLY NOISELESS, PRACTICALLY FRICTIONLESS.

This illustration shows center of axle, broken out in order to reduce size.

WRITE US FOR CATALOGUE

We can also furnish wheels fitted with bearings and tired with Kelly Solid Rubber Tire : : : : :





THE GRANT AXLE & WHEEL CO.,

SPRINGFIELD, OHIO.

Box 750.

BOILERS AND ENGINES

FOR VEHICLES.

STEAM CARRIAGES.

Carriage Boiler, Class A.

STEAM CARRIAGE, DOS-A-DOS STYLE.

Engines and Boilers Built to Order.

Also Steam Delivery Wagons and Omnibuses

Carriage Engine, Class B.

EDWARD S. CLARK,

272 Freeport St., Harrison Square, Boston, Mass.

SEND STAMPS FOR CIRCULARS.

MOTOR WHEELS.

STEERING DEVICE

WITH

BALL BEARINGS.

RIMS. CRESCENT SHAPE AND FLAT BASE

FLARING EDGES IF DESIRED.

WESTON-MOTT CO., UTICA, N. Y.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. V. NEW YORK, FEBRUARY 14, 1900. No. 20.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:

AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

R. I. CLEGG, Mechanical Editor.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

"The Trust."

We still see references to the automobile trust in the daily press. Such a concern, we are informed, has sold out to "the trust," or some gentleman of small conscience and unlimited ignorance of the subject, posing as spokesman for "the trust," fills the columns of the papers with wild talk of somebody's patents which "the trust" owns, and which will enable it to control the entire motor vehicle industry of the country.

It is unfortunate that such loose talk should find its way into the columns of our newspapers, but accuracy in matters mechanical or commercial is scarcely to be looked for in the jumble of scandals, rumors and sensations that are served up by the average American newspaper. So far as the editor's knowledge goes, there are two trusts operating in this field in America to-day—the Lead Cab Trust and the Anglo-American Trust of Pennington and Lawson. Neither of these has any solid foundation or can offer any statement entitling it to the confidence of the investing public. They were both conceived in iniquity and have been bolstered up by misrepresentation and deceit. The final disclosures cannot be long delayed.

It is true that capitalists of large means have been purchasing motor vehicle patents for some time past, probably with the intention of some day exacting tribute through their ownership, but of motor vehicle patents there will be no end. They will multiply like the dragon's teeth of old—too fast to be successfully monopolized. Steam engines, gasoline engines, electric motors, storage batteries and transmission devices are all old and well worn, and the number of permutations and combinations possible under these general heads is legion.

No one preparing to manufacture motor vehicles need be intimidated by the threats and bluffs of these alleged trusts.

Acetylene Motors.

A correspondent, whose letters we print in this issue, is a firm believer in acetylene as the coming fuel for vehicle motors. He cites the odor of the gasoline vehicle as a point in which it cannot compare favorably with the acetylene motor, because certain proportions of acetylene and air produce odorless combustion. He also regards acetylene as safer than gasoline. Price, up to the present time, has been an unsurmountable barrier to the extensive use of acetylene for any purpose, but he is of the opinion that in another year we shall be able to buy it in quantities in any village.

We hear less of acetylene now as a possible motor fuel than we did three or four years ago. At that time many experiments were being carried on in Europe and the United States, with the object of utilizing it for power purposes; but the new agent was found very difficult to control. Its explosive force is tremendous, and many of the early experi-

menters fell victims to its unexpected violence. Mr. Bronson's remarks on the odor of gasoline would probably apply as well to acetylene. Certain proportions of gasoline vapor and air produce practically odorless combustion, but the difficulty is to keep these proportions uniform in the varying conditions of vehicle service, such as variations of speed, temperature and ignition difficulties. It is not exactly clear to us how the use of acetylene would affect the odor of the exhaust.

Motors of special construction would undoubtedly be necessary for acetylene, as the heat generated from its explosion is more intense than that produced by the combustion of the gasoline mixture. This would necessitate additional complication. The cost of calcium carbide will doubtless be reduced gradually from this time on, but Mr. Bronson's statement that it will be possible within a year to purchase it in commercial quantities and at an available price in any village strikes the editor as somewhat sanguine. However, we have entertained hopes that in time acetylene would prove a suitable fuel for vehicle motors, and we have persistently scanned the current automobile literature of Europe, where most of the experimenting in this line has been done, for news of practical progress in this direction. Up to the present time, however, we have been unable to learn of any substantial evidence which could give stronger color to that hope. Acetylene seems to be still much in futuro, while gasoline as a motor fuel is a present fact.

We are very anxious for further light on the possibilities of acetylene in this field, and hope some of our readers will respond to our request for further information.

Storage Battery Tests.

The Automobile Club of France announces that the result of its storage battery tests is disappointing, and that the tests will not be repeated next year. The artificial shaker, which was improvised for the occasion, was not in working order one-fourth of the time, or the results would have been more disappointing still. After this and many more indubitable proofs of the shortcomings of the storage battery for vehicle work, the Lead Cab promoters should revise their figures and clothe themselves in sackcloth and ashes.

Competition for the Lead Cab Trust.

We learn from trustworthy sources that the Lead Cab Trust is to have competition, not in stock jobbery, but in the public cab business. The New York Cab Co. has constructed a number of gasoline cabs under the superintendence of a gentleman who was connected with the London Electrical Cab Co., and these vehicles will soon be subjected to a test in New York.

The Lead Cab Trust will begin to realize at some not distant day that while the automobile stock market is on the decline, the business situation is improving every day. The public is no longer satisfied with paper, but is determined to have motor vehicles. The gasoline public cab is a business proposition; the Lead Cab is impracticable.

The Automobile Club's Exhibition.

The announcement that the Automobile Club of America has decided to hold an exhibition of motor vehicles next fall will be welcome to all friends of the new industry. A representative exhibition under the club's auspices will correct the errors of the past and give a new impetus to the movement all along the line. The shows so far held have been little better than travesties of a great industry.

It is the desire of the club to secure suitable premises for an outdoor exhibition, where the vehicles can be seen in operation, and where practical tests and competitions can be made a feature of the programme. In this manner the public will be able to get tangible evidence of the reality and practicability of the motor vehicle and will rid themselves of the foolish notions in regard to it which daily newspapers and irresponsible promoters have fostered.

Pivot Steering.

In our next number we shall commence the publication of a series of articles on pivot steering. These papers have appeared in the pages of our contemporary, La Locomotion Automobile, and have excited considerable attention abroad. The author, M. Boulet, is a well-known D.Sc. of Paris, and an enthusiastic member of the Automobile Club of France. The series will be prepared by our Mr. Clegg, who will welcome any criticisms or new ideas in this direction of motor vehicle research.

Motor vehicle promoters are showing a disposition to emigrate. The Anglo-American combination has changed the scene of its operations from London to New York, and the Lead Cab Trust has invaded the City of Mexico. Perhaps when the nature of their business is better understood they will visit more distant climes.

The Young Hercules—the motor vehicle industry—is struggling with the monster, Fraud. Will the lusty infant throttle the monster, or will it crush his life out in its snaky folds?

The De Dion-Bouton Patents.

Our London correspondent last week conveyed the important information that De Dion & Bouton, of Paris, France, inventors of the jacketless motor now so generally used on tricycles and voiturettes in England, France and other European countries, are proceeding against alleged infringers of their patent rights in several countries, and propose to make an aggressive contest immediately wherever patents have been granted to them. We believe the only patent they have taken out in the United States on small gasoline motors refers to the ignition device illustrated and described in our last issue. We shall shortly print an article going rather minutely into this patent, in the endeavor to determine what its chief features are, and to what extent it is being imitated in America to-day. Mr. Clegg's "Explosive Motor in Detail," in our Explosive Motor Number, is believed to avoid infringment, and several foreign manufacturers are producing similar motors, which are claimed to be free from liability; but the claims of the De Dion patent are very broad, involving the notched disk in combination with the shoe, and some interesting litigation may be looked for in this country before the validity of this claim is settled.

Variable Throw Devices.

We wish to direct attention to a very interesting patent, described in this issue, on a variable throw lever clutch for motor vehicle driving. Hundreds of inventors in all parts of the United States, have been experimenting on different forms of direct transmission for gasoline vehicles to avoid the necessity of belts, chains, gears, etc. The one general objection to all these variable throw cranks has been the lost motion involved and the lack of positiveness of the gripping device. The inventor whose work we now illustrate believes he has conquered the difficulty. The mechanism is highly ingenious and will repay careful dissection.

Any of our subscribers who are willing to solicit subscriptions for The Horseless Age from their fellow townsmen are requested to communicate with the Editor, as we are desirous of entering into business relations with such parties.

Motor Vehicle Franchise Grabbers?

Two bills have been introduced in the Massachusetts Legislature which, if they should become law, will convey sweeping privileges for the operation of motor carriages in Boston to a group of promoters headed by J. Emery Harriman, Jr. They are much alike in purpose, though titled and worded differently, and they revive a scheme which occasioned some little contention in the Legislature of last year. The prime feature of each is the incorporation of a company to build a radial elevator tower at the end of an ocean pier which is one of the attractions at Marine Park, South Boston; but coupled with this is the proposition to empower the company to carry passengers to and from the tower, "over the pier at Marine Park and through adjoining parkways," by means of motor vehicles. Now, it is but a few hundred feet from the nearest city thoroughfare through Marine Park to the pier, so that if this were all that were meant by the phrase, "through adjoining parkways," the bill could not be taken as very much of an inroad on the restrictions of the Boston Park Commissioners on automobiles (debarring them from all the parks after 10:30 a. m. and before 9:30 p. m.). But it happens that a new parkway, called the Strandway, is now under construction, which, when completed, will connect the Marine Park, jutting out into Boston Harbor from South Boston, with the new Columbia Road Parkway, and thus with the great chain of park drives included in Franklin Park, the Back Bay Fens, and intervening parks bordering the south and west of the city (which, by the way, in time will be connected with the corresponding chain of parks to the north and eastward, from Middlesex Fells to Rever Beach and Lynn Woods). Consequently, it is held by many that if this bill goes through the motor carriage clause concerning the parks will be a privilege of inestimable value, since it will give the company practically a free run of the parks in the very face of the Park Commission's prohibitory regulations. Under the bill, it is held, there would be no need for the company to use the city thoroughfares at all, since, with the completion of the Strandway, it would have opportunity in the parks alone for an automobile service that might prove highly remunerative, even without the construction of the radial tower as an objective point, or terminal, especially since the street car lines at present can merely cut the park system at various distinct points, without affording any continuous transportation from point to point over the parkways.

When the bill for this tower and its attendant motor privileges was introduced last year, it was put through the mercantile affairs committee, to which it was referred, with practically no opposition, and with almost no comment, except the few words of explanation offered by a representative of the promoters. But when it was reported favorably in the House of Representatives, the Park Commissioners at length were aroused to its real significance, and Chairman Charles E. Stratton at once exerted all his influence to have the bill downed. After brief discussion on the House floor it was recommitted. Mr. Stratton appeared before the committee and explained his opposition to it, and in spite of the effort of several of the members of the committee to have the construction of the tower authorized, the bill was sent to the House for the second time, this time with an adverse report on it. That ended it for that year.

The bills of this year are two, one asking for the incorporation of the "Marine Park Tower Co.," and the other for the incorporation of the "First Motor Vehicle Co." Both provide for the building of the tower, the running of motor vehicles as outlined above, and also the carrying of passengers to the top of the tower by elevators or otherwise, the maintenance of an amphitheater in the tower, and observatory, places for refreshment, amusement, games and entertainment, as well as the purchase from the city or other persons of land, buildings and locations needed to enable the company to carry out its plans in connection with the tower.

No Motor Vehicles in this Cemetery.

The directors of Forest Hills Cemetery, one of the most beautiful cemeteries in the Boston (Mass.) district, have barred out all automobiles. They placed a sign at their entrance a few days ago announcing: "Automobiles not allowed in this cemetery;" and only horse-drawn carriages will hereafter be allowed entrance. The directors have followed in this action the course taken by the Boston Park Commission, much of whose domain lies almost contiguous to the cemetery, and the reason given by the cemetery people is substantially the same as that of the Park Board. They are afraid automobiles will frighten horses. A correspondent of The Horseless Age asked Secretary Potter of the cemetery corporation for the reasons in detail for shutting out the automobiles. The secretary said: "We have a large number of lots here which we are bound to keep in order perpetually, making good any damage that may be caused. Some of these lots contain monuments valued at several thousand dollars each. If a runaway should occur, you can see that a great deal of damage might be caused. If an automobile, for instance, should suddenly approach a funeral procession, there might be a deal of trouble. My experience has been that some horses can't get used to an automobile, and with so much valuable property in our charge, we do not care to take any risks."

The order hits some of the very lot owners of the cemetery. Richard H. Lufkin, for instance, has been accustomed to run out from town in his own automobile to his lot; but on his last trip he had to leave the automobile at the entrance and proceed to the lot on foot. Some of the outside automobilists have been in the habit of cutting through the cemetery when out for a ride; but all will now have to keep out. Secretary Potter says the directors do not object to automobiles in themselves, but merely fear the damage. When horses have become accustomed to them the ban will be removed.

Automobile Regulations of Brookline, Mass.

Brookline, the wealthiest town near Boston, noted for its fine residence streets and drives, has been a mecca for automobilists ever since they began to be at all common in this neighborhood, but now Brookline has found it advisable to place restrictions on horseless vehicles. The rules adopted by the Selectmen are as follows:

1. No automobile used either wholly or in part in the town of Brookline shall be run within the limits of said town at a rate of speed greater than 10 miles an hour.

2. Every public automobile used either wholly or in part in the town of Brookline shall bear the number of its license in a conspicuous place in the rear of the carriage in figures of Arabic characters, not less than 2 in. in height.

3. Every person in charge of an automobile waiting for passengers in any street, square or public place in Brookline shall obey the directions of any police officer respecting the place of standing, and the route to be taken when going to or leaving such place.

4. The owners and persons having charge of an automobile used in violation of any of the foregoing regulations shall forfeit and pay for each offense a fine not exceeding $20.

Automatic Igniter for Steam Vehicle Burner.

E. H. Lyon, Englewood, N. J., has devised many little refinements and improvements for motor carriages. His latest idea is an automatic electric lighter for his Locomobile boiler. It consists of two dry cells and a 6-in. coil, the latter fastened on the inside of the carriage body and the former carried in the tool box, and a magnet and a vibrator. The stem of the igniter stands permanently in one of the air holes of the burner and is supported on a bracket screwed to the wood work underneath. The device is operated from the seat by pressing a button and turning on the fuel, when the buzz of the vibrator will give notice if the effective spark has been obtained, thus avoiding waste of fuel.

One great advantage of this automatic lighter is the ease with which the fire can be extinguished and relighted, preventing blowing off of the boiler and consequent frightening of horses.

The manufacturer of the device is A. L. Bogart, 123 Liberty St., New York, a specialist in electric lighting.

Motor Mails Collection Recommended.

Owing to the success attending the recent tests in the collection of mail by motor vehicles at Washington, D. C., Postmaster Merritt, of that city, has recommended to the Postmaster-General the adoption of motor vehicles for this purpose in all our large cities.

The matter is now in the hands of First Assistant Postmaster-General Heath, who is strongly in favor of the new service. Probably it will be some time before the large cities generally will be equipped with the service, owing to the fact that there is no money available out of the last appropriation for the purchase of a large number of carriages. Congress will undoubtedly be asked to include an amount for this purpose in its next postal appropriation.

The Autocar Co. Raises Prices.

The Autocar Co., Pittsburg, Pa., inserted an advertisement in The Horseless Age a few months ago to the effect that they were manufacturing a light runabout at the extremely low price of $500. This price, they state, was based on contracts for material made almost a year ago. These contracts having expired, and a large increase in wages being demanded by workmen, they cannot at this time and under present conditions make a vehicle for this price without slighting the work or buying inferior material. Hence, they have remodeled their runabout pattern and raised the price to $650, to which a small additional cost will be added for leather top and special fittings.

The company will be in their new factory, located at Ardmore, Pa., just out of Philadelphia, about April 1, and all orders which have been placed with the company will be delivered from the new factory. A large force of men will be employed, and the plant will be run by automatic machinery, and the work will be done in duplicate. They expect to fill all their present orders by May 1. The capacity of the new factory will be about four vehicles a day. Photographs and information of this year's model will appear in The Horseless Age within the next few weeks.

MINOR MENTION.

C. S. Schmick, Catawissa, Pa., is building a steam carriage.

Owners of automobiles used for hire in Chicago, Ill., are said to be preparing to contest the new license law.

The Monroe Automobile Transportation Co. has been organized by Stroudsburg, Pa., capitalists.

Postmaster Wilson, Brooklyn, N. Y., is experimenting with a Locomobile for the collection of mail.

The Locomobile Co. of America has leased the plant of the Spiers Mfg. Co., East Worcester, Mass., as additional factory.

The Stanley Mfg. Co., Lawrence, Mass., have received an order from England for carriages.

The Oneida Rubber Tire Co.'s steel rim business has been consolidated with that of the Weston-Mott Co., Utica, N. Y.

The Pennsylvania Rubber Co., Erie, Pa., are introducing a new motor vehicle tire called the Middleton Tough Tread Tire. It has a number of novel features.

Charles B. King, Detroit, Mich., is now connected with the Olds Motor Works, of that city, and is devoting his attention to the marine engine department.

The Keating Wheel & Automobile Co., Middletown, Conn., is being reorganized to provide for the raising of $200,000 to carry on the automobile business.

Charles E. Foster, a well-known patent attorney and consulting engineer of Washington, D. C., has been granted the first Locomobile license in that city.

The Woods Electric Vehicle Co., of Wisconsin, has been organized, with $100,000 capital, to operate Lead Cabs in Milwaukee.

The Stringer Automobile Co. has been organized at Marion, O., with $20,000 capital, to manufacture gasoline vehicles invented by J. W. Stringer.

The Philadelphia Exposition Association has decided to defer the automobile exhibition it had under consideration for another year.

The Aldermen of Paterson, N. J., have granted a franchise to the Union Transit Co. to run motor vehicles in the city on condition that the company pay to the city on Feb. 1 of each year 2½ per cent. of its gross receipts.

A new corporation under Virginia laws is the Autocarette Co., capital $200,000, organized to build and operate motor vehicles in Washington, D. C. O. G. Staples is president and W. E. Schneider, secretary.

Albert Frech, Newark, N. Y., has purchased the gasoline engine business of W. E. Watkins and A. J. Short, Phelps, N. Y., and removed it to Newark, where he will manufacture launches and automobiles.

The Goodyear Tire & Rubber Co., Akron, O., are distributing a handsome lithograph of their trade mark, in which the tire serves as the frame of the picture of a pretty woman in gay colored attire.

The Locomobile Co. of America has taken possession of the old plant of the Liberty Cycle Co., Bridgeport, Conn., and will eventually concentrate there, moving its Newton and Westboro plants thither and employing a large force of hands.

The Shelby Steel Tube Co. of America was recently incorporated in New Jersey, with $15,000,000 capital, to manufacture metal tubing for use in vehicles and other arts. Of the capital stock, $6,000,000 is preferred, with 7 per cent. cumulative dividends.

It is reported that the Anglo-American Rapid Vehicle Co. is arranging for the rental of the ground floor of the old Victoria Hotel property, at Twenty-sixth St. and Broadway. They have been keeping their vehicles in the old car stables on Sixth Ave. and Forty-fourth St.

Ough & Waltenbaugh, the engineers who designed the Eureka gasoline carriage described in our Explosive Motor Number, have removed from San Francisco to Chicago, Ill., where they will manufacture it. Their new address is Stock Exchange Building.

J. A. Webb, a citizen of Chicago, Ill., has sued the Illinois Electric Vehicle Transportation Co. for $5,000 damages alleged to have been caused by a collision between a buggy in which the plaintiff was riding and one of the company's Lead Cabs.

E. H. Cutler, of the Elektron Mfg. Co., Springfield, Mass., and H. A. Knox, an employee of the same company, have organized a new company, called the Knox Automobile Co., for the manufacture of gasoline vehicles invented by them. The capital stock is $50,000, and the officers are as follows: W. E. Wright, president; H. A. Knox, vice-president; E. H. Cutler, treasurer, and Albert E. Smith, secretary. The plant of the Waltham Watch Tool Co. will be leased for a factory.

The Oceanic Automobile Co. has been incorporated in New Jersey, with $400,000 capital, by New York, Philadelphia and Atlantic City capitalists, to operate automobiles in Atlantic City. It is an offshoot of the Electrical Development Co., of Philadelphia, and the officers are: Reginald A. Kennedy, of Hamilton, Ont., of the Electrical Canadian Power Co.; Charles S. Lee, of New York, general passenger agent of the Lehigh Valley Railroad; E. B. Byington, of Philadelphia; Charles H. Walters and Richard F. Loper, also of Philadelphia; A. M. Jordan, William H. Bartlett and others, of Atlantic City.

Pennington's "Peculiar Statements."

Unless our American correspondent has misunderstood him, Mr. Pennington appears to be making some rather peculiar statements in the United States. It would appear that he labors under the impression that thousands of his vehicles are under contract to be made in this country. Of course, we do not say that it is not so, but we confess we have so far failed to come across the vehicles, even one at a time, still less in their hundreds or thousands.—The Autocar.

COMMUNICATIONS.

Theoretical Questions Relative to Our Explosive Motor Number.

Detroit, Mich., Feb. 7.

Editor Horseless Age:

In the Explosive Motor Number of The Horseless Age are some things that I wish to inquire further concerning:

Why does Mr. Towle say that the vapor of gasoline has a specific gravity of 1.5 to 2.5, relative to air? I have been led to believe that it was rather from 2.5 to 3.5.

I hope soon to see reliable data upon this important point obtained under the patronage of The Horseless Age. Surely, we should understand the material with which we have to deal. This should help us to clear up many doubtful points.

I was much interested in the article by Professor Oliver on the "Gasoline Engine Indicator Diagram." Why does he assume an exponent for V of 1.41 in his fundamental equation?

This gives a line, I understand, a little steeper than the adiabatic for air. For a gas engine 1.37 is the exponent for the adiabatic curve, and Professor Perry says that the value may be slightly greater than 1.37 for a gasoline engine. I have thought that it was not to be expected that the expansion line would more than roughly approximate the adiabatic.

The following are some exponents of V, worked out from actual diagrams by eminent authorities quoted by Professor Robinson:

Name of Engine	Exponents of V. Compression	Expansion
Otto	1.335	1.363
Atkinson	1.399	1.305
Griffin	1.262	1.373
Crossley (Otto)	1.36 or 1.38	1.433
Atkinson	1.205	1.264
Griffin	1.245	1.35
Average	1.304	1.348

The compression line in the interesting diagram given by Professor Oliver seems remarkably low. Assuming the pressure at the commencement of compression as 14 lbs., the exponent of V that would give 78 lbs. compression would be about 1.17. With 1.41, the final pressure would be 107 lbs., if my figures are correct, although in the theoretical curve given the final pressure seems to be less than 100 lbs.

The given theoretical expansion line seems to indicate 57 lbs. at the end of the out stroke, and therefore the theoretical pressure at a volume of 103 cu. in. would be about 438 lbs., or about 104 lbs. higher than the actual pressure. The large ratio between the actual explosion and compression pressures might be thought to be due to the fact that the compressed charge was comparatively cool just before ignition.

Is it not just as well to assume an exponent $\frac{4}{3}$ or $1.33\frac{1}{3}$ so that we will have whole numbers to deal with, and may use a table of square and cube roots?

This exponent would give us a compression of about 96 lbs. to 100 lbs., and, assuming a final expansion pressure of 51.5, the theoretical explosion pressure would be about 354 lbs.

The diagram, as measured by a planimeter, seems to indicate about 2,700 foot-pounds per stroke. A formula derived upon the assumption of an exponent of $\frac{4}{3}$ for V would give about 2,500 foot-pounds per stroke.

With the cool compressed charge unusual efficiency is to be expected.

I wish Mr. Clegg would tell us what units to substitute in the formulas on page 51. Are h and d to be taken in meters, centimeters, feet or inches? It seems to me that the amount of compression will have to be taken into account.

E. J. STODDARD.

Variable Throw Lever Clutch.

Buffalo, N. Y., Feb. 6.

Editor Horseless Age:

Referring to my patents, just issued, and to my experimental wagonette, photograph of which I inclose you, it may be interesting to you to know the results of my work in my effort to produce a horseless wagon that is capable of doing heavy duty.

My experiments with a lever clutch of variable throw have demonstrated that I can give a positive and unlimited speed to the wheels, either backward or forward. I thus produce a wagon capable of any speed desired, without the aid of any complicated gearing, belting, or friction mechanism. With the adjustable wrist pin, adjustable while in motion, and automatically balanced, I have demonstrated that I can swap speed for power—i. e., by shortening the throw reduce the speed of the machine, and, at the same time, double up on the power. For example, take a 4-in. throw crank, with the motor producing, say, 2-h.p. Drop the crank down to ½-in. throw, and it is evident that the power is increased to 16-h.p. Of course, the speed of the vehicle is reduced thereby, but if the power can be obtained in this manner, I contend that it is the solution of the trucking problem. With my variable speed running gear it is immaterial what power is used—steam, gasoline, electricity or air.

On my experimental wagonette I used two Benz gasoline motors, 5-in. x 7-in., 25 per cent. of the stroke allowed for compression. The vehicle weighs 2,700 lbs., and I have hauled 3,000 lbs. of men and boys without any apparent effort on the motor. Your truly,

A. J. MARTIN.

Advocates Acetylene.

Ottawa, Canada, Feb. 10.

Editor Horseless Age:

I was much interested in the contents of the Explosive Motor Number of The Horseless Age, but must confess some disappointment at the limited reference to acetylene gas as a prospective power for automobile work.

Those who have looked most thoroughly into the merits of calcium carbide seem to consider that it will ultimately prove, all things considered, a more satisfactory power for such requirements than any yet tested. Following are the reasons for such belief:

You have probably noticed at different times the criticisms, on account of odor, urged in Paris against all vehicles propelled by gasoline. I am, of course, aware that manufacturers of gasoline carriages claim that these odors are reduced to a minimum; but that minimum, though perhaps never

noticed by the happy rider, is very disagreeable to bystanders, if we may judge by the ample evidence given. And, in event of a number of such vehicles traveling within the limits of one of our city blocks (which conditions, you will admit, are to exist in the very near future), the "minimum" vile odor of each, added to all of the others, would certainly be sufficient to warrant the question, "Is there no substitute by which this aroma can be dispensed with?"

You are no doubt aware that acetylene gas, when exploded in combination with certain proportions of air, emits absolutely no odor, and that the proportions best suited for motor purposes are, fortunately, those giving off no odor. Such being the case, will not the gasoline vehicles be apt to be legislated against sooner or later and ruled off from our more frequented thoroughfares?

In other words, the public has certain rights, and if their nasal organs are seriously offended, there would seem to be but one result were an inoffensive substitute known.

Continuing the comparison: Acetylene gas has no more limitations than gasoline, as the calcium carbide can be readily stored and carried as gasoline when a long run is desirable, and, though the supply throughout the country is now very limited, within the coming year one will undoubtedly be able to renew his supply in most any country village in the land.

At present prices of carbide, the cost of operating would, of course, be greater than with gasoline; but as the market becomes supplied the cost will be reduced, whereas, the tendency of gasoline is constantly upward; so the ultimate difference need hardly be given serious consideration, especially in connection with a pleasure vehicle, as the cost is, comparatively speaking, a mere bagatelle.

I can hardly agree with the statement made by your Mr. Clegg that "if the gas is to be generated en route, the weight and complication may offset the other advantages of the hydrocarbons now in use." From what I have seen of different makes of generators, one of very simple construction and no great weight should be sufficient, and, as the gas would be used as generated, no reservoir of unwieldy capacity would be necessary. It strikes me that a very simple and practically automatic generator can be easily constructed for such purposes.

The motor accompanying would, of course, be some good type of gas engine, with construction so altered as to admit a proper mixture of gas and air.

I have been very anxious for some time past to secure a good horseless vehicle, but I do not wish one which, within two or three years, may be relegated to the back streets of our city on account of its vile odors; hence, I, with very many others, look upon calcium carbide as the ideal power for automobiles.

For nearly a year now I have scrutinized very closely every issue of The Horseless Age for news of something being accomplished with calcium carbide as a power for small motors, but in vain. I've no doubt some are experimenting quietly in this direction, but I feel that tangible results would be attained more promptly if the full merits of calcium carbide for this purpose were put into print and agitated from time to time in such a publication as The Horseless Age.

I have made no reference to the much greater safety of the carbide over gasoline for carriage purposes. This will be admitted by any unprejudiced person who is familiar with the nature of the two, and is a very important feature.

I have not written this at all as an article for publication, nor do I ask for a reply of any kind; but simply to indicate to you the channel in which the thoughts of a large number are running in connection with this subject.

Very truly yours,

W. G. BRONSON.

P. S.—One other advantage the use of calcium carbide would have over gasoline lies in the fact that the lamps, requisite for night service, would never require any attention, as they would take the acetylene gas direct from the generator supplying gas for the propulsion of the vehicle, and would consequently always be in readiness when the carriage might be in use.

Moment of the Spark.

Uhrichsville, O., Feb. 6.

Editor Horseless Age:

In your issue of Jan. 31 Mr. Struss claims there is spark only at break of primary circuit.

He is undoubtedly correct, for we find the following in Sylvanus P. Thompson's "Elementary Lessons in Electricity and Magnetism," pages 367 to 373. Speaking of induction coils he says: "The object of the interrupter is to make and break the primary circuit in rapid succession. The result of this is, at every 'make,' to induce in the outer 'secondary' circuit a momentary inverse current, and, at every 'break,' a powerful momentary direct current. The currents at 'make' are suppressed. * * *

"The extra current due to self induction on 'making' circuit is an inverse curent, and gives no spark; but it prevents the battery current from rising at once to its full value."

Respectfully,

E. S. WOODHORNE.

More Explicit Information Wanted.

Reading, Pa., Feb. 9.

Editor Horseless Age:

It is a pity that Mr. Stoddard, in his article on "Gasoline and Gasoline Mixtures," in your Explosive Motor Number of Jan. 17, did not give more detailed information in regard to his device for measuring vapor tension. Such an instrument should give reasonably correct results if properly handled; but we fear that any one attempting it with no more information than he gives would have difficulty in reaching practical results. Can he not furnish more explicit instructions?

Yours truly,

HERBERT L. TOWLE.

"May their Tribe Increase."

West Chester, Pa., Feb. 11.

Editor Horseless Age:

I wish to commend the honorable position you have taken in regard to the numerous frauds that are being placed before the public, which, if successful, would greatly cripple the automobile industry. Your aggressive editorial policy will in a great measure offset this danger, the last number of your excellent journal being particularly deserving of the careful perusal of every prospective purchaser of an automobile.

Wishing you continued success, I am, yours truly,

J. MAX MEYERS.

The Mechanical Horse.

By R. I. Clegg.

The trite but true adage that "History repeats itself" is strikingly exemplified in the progress of motor vehicles, as in other branches of engineering, etc, the interest manifested at the present time in a certain direction of vehicle design having a close parallel in an essay published some 75 years ago in the Mechanics' Magazine, where the writer, noting the interest in the automobiles of his time, looked forward to the displacement of the equine even for saddle riding, and pictured the young man mounted upon a metallic steed. At the present day the mechanical horse is being exploited to some extent abroad, but has attained but a feeble growth in this country as yet. By the "mechanical horse" we mean the tractor system of propulsion, or the power-driven fore carriage, as it is sometimes called. There is nothing particularly novel in the idea of applying power to the steering wheels or to all four wheels of a motor vehicle at the same time; these were tried in the early years of the century by Burdstall, and, doubtless, other engineers. The methods were crude but not the less interesting as showing the same line of reasoning that has in our day produced the Bogie Heillmann, the pony of Reancy and Gevin and the Pretot tractor, in France

Here is the Heillmann carriage in Fig. 1, and the picture illustrates quite clearly the advantages, as well as the disadvantages, of the system in general.

The inventor is well known to engineers as the designer of the Heillmann locomotive, which carries a complete electro-steam generating plant, the steam boiler and engines operating dynamos, which in turn are connected to motors on the axles. The "Bogie" is driven by a storage battery or explosive motor, as the purchaser may choose, and as will be noted from an inspection of Fig. 1, is likely to transmit little or no vibration to the passengers. The horse is here absolutely supplanted, and in his place, whether it be the equipage of wealth or the ordinary road vehicle is immaterial, the bogie is readily applied. There is an obvious benefit in the ability to change so easily the combination of horse and carriage in the possibility of injury to either, and this would be of greater weight where a number were in use, as in the general delivery service of large stores or express companies, etc. The grouping of the mechanism in front renders repairs easy, even if the entire arrangement is not so easily removed from the body of the vehicle; but the effect is not pleasing to the eye in this instance. It looks unwieldy, and, beyond a doubt, approaches the equine in the difficulty of manœuvre.

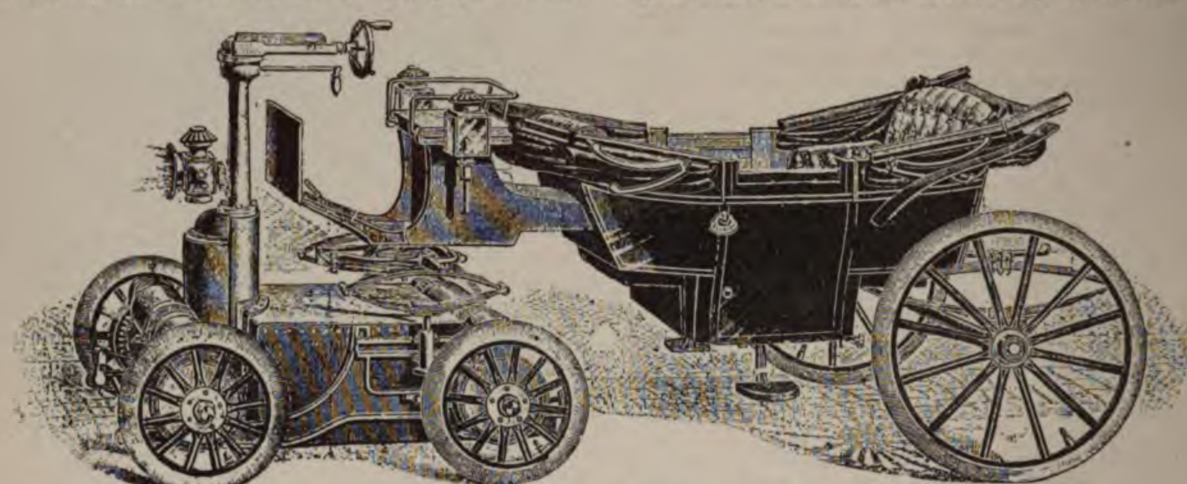


FIG. 1. THE "BOGIE HEILLMANN."

In Fig. 2 is shown a happier endeavor—the Pretot motor system, operated by an explosive engine contained in the casing seen at the left of Fig. 2 in the detached fore carriage. The motor is made in sizes from 5 to 10-h.p.. The gearing permits of three speeds and a backing motion, controlled by the one lever. The gasoline tank is seen immediately behind the leading wheels, and the upright tank in front is the water reservoir. This last, by the way, should be avoided, if possible; it has a most ungainly appearance, and, although explosive motors of over 5-h.p. are with difficulty operated with-

FIG. 2. THE PRETOT SYSTEM.

out water, it would seem that the designers of so compact and ingenious an arrangement as this could have devised something less obtrusive than the tank shown in front of the dashboard in Fig. 2.

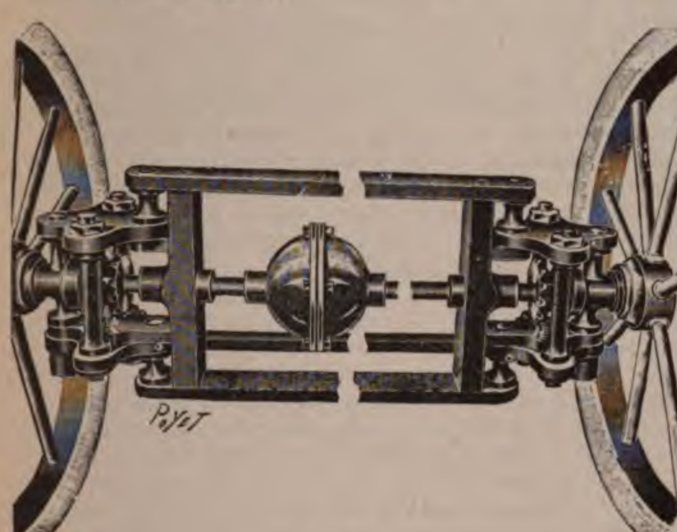


FIG. 3.

The system devised by MM. De Reancy and Gevin very closely resembles the Pretot, with two exceptions; first, the steering, which is accomplished by means of a lever, instead of wheel, and having a strong family likeness to the tiller of the Whitney or the Duryea carriages. It starts and stops, steers, changes the speed or applies the brake. Second, the motor is cooled by flanges. The motor is placed parallel with the axle at the front, so that the cylinder forms one side of the casing. The cylinder is double the ordinary length and contains two pistons. By means of links the piston rods are attached to cranks set at 180 deg., the crank shaft passing under the cylinder. A single explosion acts upon both pistons, driving the one to the right, the other to the left. The standard type runs at the rate of 300 turns a minute, and at this speed is said to give 3-h.p.

It is not intended to repeat the accounts of motor wheels with which the readers of The Horseless Age are well acquainted, and the foregoing types are representative of the better known machines of this class abroad. Apart from these

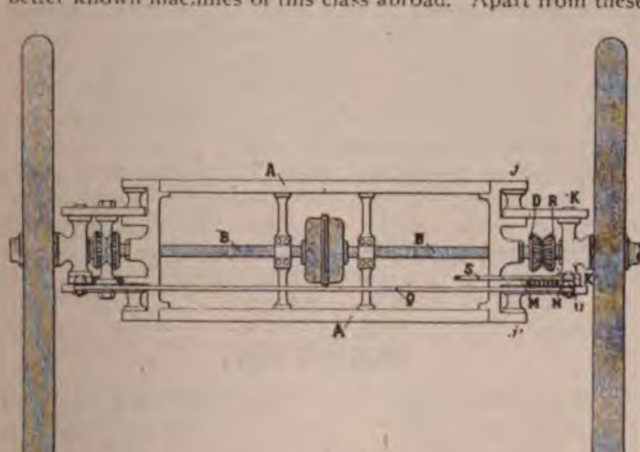


FIG. 4.

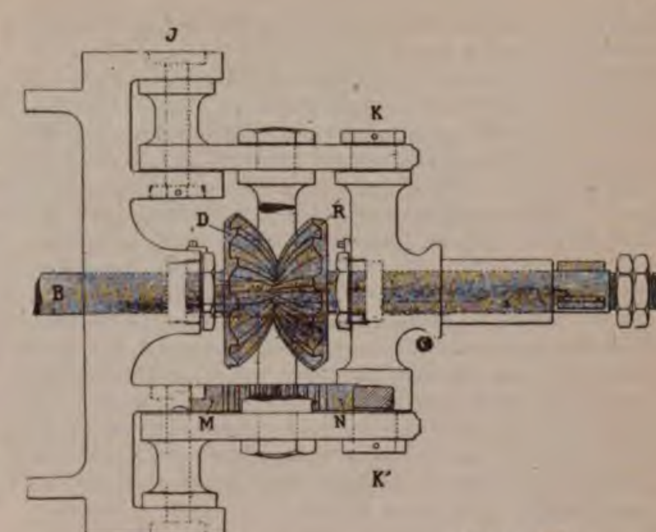


FIG 5.

devices, each capable of ready removal from one vehicle and attachment to another, comes the class where the power is still applied to the steering wheels, but the generator is attached to the body of the vehicle, and the transmission more nearly approaches the other common methods, as by gears, chains, etc. One of these, designed by M. Baudry de Saunier, has been illustrated in the France Automobile. Fig. 3 shows the complete arrangement in perspective. Fig. 4 is an elevation of the device. Here A A is the frame; B B is the motor-driven shaft, with differential gear; D is a hemispherical gear, keyed on the end of the shaft B; R is a like gear to D, keyed on the wheel spindle; K K, bearings for the wheel movement about the joints j j; M M, the gear guides; U, crank for steering the wheel on the right; S, the steering lever; Q, the connecting rod attached to the crank U, and maintaining the wheels in parallel.

Fig. 5 gives the details of gearing. B is the axle, with gear D; R, the wheel spindle gear; M N, the gear guides; K K, check nuts of the spindle through the linkage; j j, the

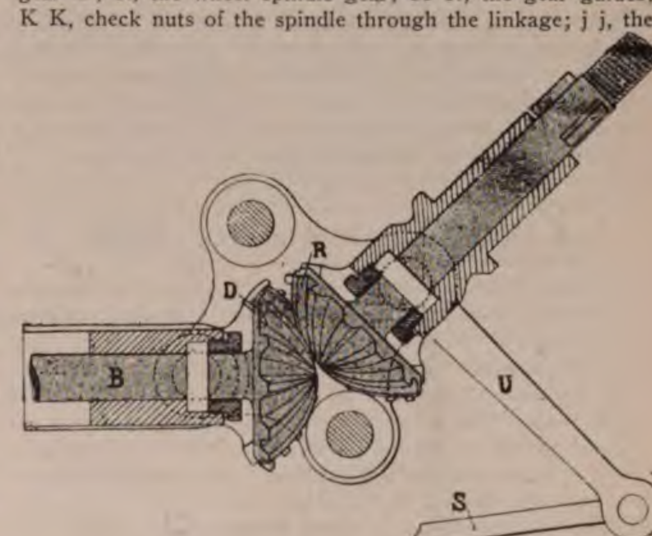


FIG. 6.

joints allowing movement of the wheel, yet maintaining a connection with the shaft B.

Fig. 6 is a sectional plan, showing the control of the wheel from the axle when the axes are at an angle. Fig. 7 is a similar plan of the gear guides, the spherical gears and spindle bearings being removed, the letters on Figs. 6 and 7 having reference to identical parts as similar letters on Figs. 4 and 5. The spherical gears act as claw clutches, and a universal joint could be substituted for the gears with little or no modification of the scheme. The inventor points out a peculiar advantage in these gears, viz., that as the wheel is twisted around at an angle the gear teeth in mesh are thicker and stronger, their resistance being proportionately to the work that they transmit. In order that the gears shall mesh nicely at any angle, the inventor places below them the toothed sectors M and N, which serve as guides. The sector M is fixed, while N is movable with the wheel. M. Saunier calls attention to the practicability of inclosing the gears in a case and flooding the gearing with oil.

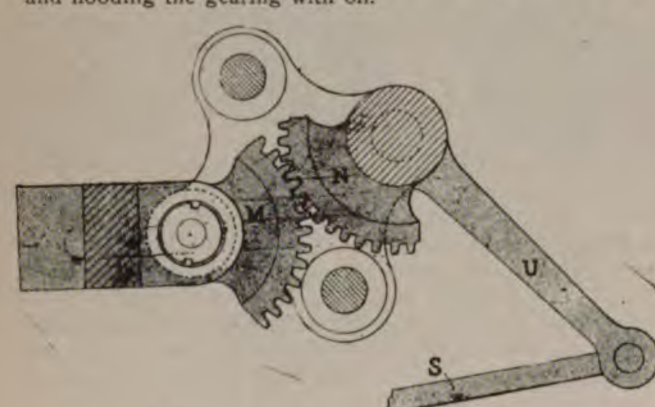


FIG. 7.

So far as can be ascertained, no vehicle has yet appeared having this particular avant train as a part of the mechanism, but the device is well worth more than a passing glance by the student. The above device is not included in the articles on pivot steering to be published in The Horseless Age, and on that account a brief description is here presented.

A Doleful Tale and Its Moral.

We quote from the Elmira (N. Y.) Telegram the following doleful tale of hopes decayed and faith misplaced, trusting that the moral will be plain enough to deter some other enthusiasts from wasting their substance in profitless experimenting. Practical motor carriages are not built at every country cross roads. The town where all this experience was so cheaply gained was Horseheads, N. Y., aptly named when the result of the experiments is borne in mind, for the horse had by long odds the best of it after all.

"This village will never become famous as the center of the 'mobile manufacture of the world. Last summer, when Dr. ——— announced that he would manufacture one of these kittenish vehicles, Horseheads people naturally puffed out their chests and added a couple of reefs to their air of importance. The Doctor was visibly pleased at the many manifestations of the important figure which he cut. But since then there have been changes, and now, if you want to keep your place in the Doctor's good graces, you must not say anything about automobiles. The manufacture of these self-propelling wagons is even yet in its infancy. Every day people are learning something new about the automobile, and Dr. ——— is no exception. When the Doctor decided last year that he would have an automobile of his own make, he arranged with Milton E. Updike for the latter to construct the gasoline engine which was to give the wagon its motive power. Levi Bulcy, a wagon maker, was engaged to make the wagon, and William F. Rose volunteered to see that the iron work was all right. Updike, who conducts a bicycle repair shop, had previously made several very clever articles for Dr. ———, and he felt sure that the gasoline engine would be a success. Right here is where all the question lies: Was that engine a success or was it not? To tell the story. The wagon was duly constructed, and Updike announced that the engine was ready to be placed therein. The work had been done in a vacant building on John St., and it was elected that the trial of the automobile should occur there. Now, the accounts of the official test are varying indeed—so much so that the case has gone on the court records. Everything was ready for the trial. The interested parties had gathered, and the power was turned on. Those who participated are unable to tell with any accuracy just exactly what happened then. Some say the way that wagon caroused around the room was a caution. It banged into its makers, bucked the brick wall and tried to climb up the side walls. It refused absolutely to be stopped in its mad career, and when the referee called time everybody and every movable thing had been laid low. The 'mobile was hopeless; all sorts of tinkering failed to bring it to the required standard, and Dr. ——— became discouraged. He paid Updike $10 and went back to dealing out pills. Now, Updike had spent a good many hours on that gasoline engine, and felt that $10 was a long ways from being proper compensation. The more he thought about it the more certain he was, and finally it appeared to him that it was about $100 out of the way. Accordingly, he sued the medical automobile builder. This made Dr. ——— recall that official test, and he brought a counter suit for $175 damages. In his complaint he does not say how much of this is for loss of sleep caused by worry, how much for the nervous strain of that trial trip, etc. The case was tried before a jury this week. Dr. ——— sent to Rochester for an automobile lawyer and F. S. Bentley appeared for Updike. The latter swore as experts, George McElroy and Martin Pickney, of Elmira, who testified that Updike's work was properly done and the price asked reasonable. Evidently the jury thought so too, for it rendered a verdict in his favor of $75 and costs. Dr. ——— will drive his horse this summer."

Hundreds of thousands of dollars have been wasted in this way throughout the length and breadth of the land by unmechanical persons who conceived a hasty impulse to construct a horseless carriage, and have had plenty of time to repent at leisure. The motor vehicle is a most difficult problem, even for the ablest engineers.

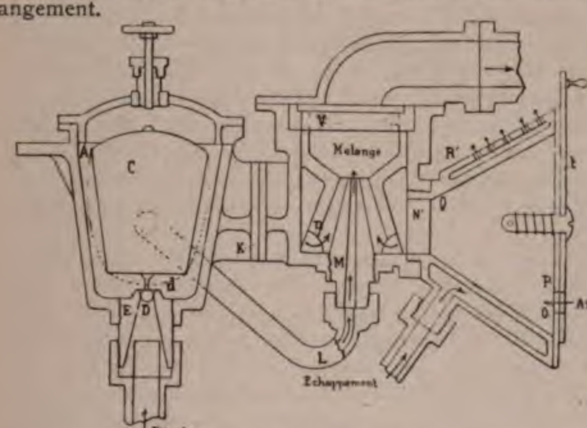
OUR FOREIGN EXCHANGES.

Le Blon Gasoline Carbureter.

The inventor states that his device is intended, first, to remedy these defective conditions produced in ordinary carbureters, where, because of the tilting of the vehicles upon which they are placed, the action is intermittent; secondly, to mix the air and gasoline under the best conditions.

It consists of a conical chamber, A, forming the reservoir. In the fluid is immersed a float, C, of a pear or cone shaped pattern. At the small end of the float C is a rod, d, screwed into a ball, D, of metal or other suitable material. This ball D is retained in a conical tube, E. To this tube E is piped the main petrol tank.

The ball D contained in the tube E, and drawn vertically by the float, remains always in position, whatever may be the inclination taken by the carbureter attached to the vehicle, and independent of the vibrations or oscillation of the whole arrangement.



LE BLON CARBURETER.

The reservoir or conical chamber A is connected to an injector, M, by the joint K and the pipe L. This injector is composed of a conical tube, M, with a casing, H, having numerous holes in the base for the passage of air between it and the conical tube. A cone, with double walls, Q R', is fixed to the injector at N'. This cone receives the surrounding air, through the openings O cut in the regulator plate t and the head P, and conducts it to the parts N and M; at the same time, this air is heated by contact with the jacketed cone casing, through which circulates the products of combustion coming from the exhaust (l'echappement) of the motor.

The mixture (mélange) of air and petrol, after leaving the injector, traverses a series of vibrating sheets, V, which break up and render more homogeneous the gaseous mixture.

It will be noted that the exhaust not only heats the incoming air, but is in turn passed through a muffler, the cone casing being arranged for this purpose.—La Locomotion Automobile.

Maintenance of Storage Ignition Cells.

The Georges Richard Co., well-known manufacturers of gasoline carriages, Paris, France, according to a French contemporary, have given the preference to storage batteries for the ignition of their motors. The batteries, however, should have low resistance and be frequently recharged from a low current. M. Richard estimates an average of 60 miles a day for an automobile, or five hours' work for the motor. The contact producing the spark lasts only about one-fifth of the revolution of the cam which causes it, so that about 2 ampere-hours would be required for each day of work, 19 hours out of the 24 the battery being at rest. Hence, a current of one-tenth ampere will be sufficient to restore the battery after each day's work, just the amount which a good dry cell will yield without danger of polarization and with the assurance of a life of 200 to 300 ampere-hours. Hence, a good battery of dry cells ought to keep the storage battery fully charged for a period of five or six months, connection being made immediately after returning to the stable. The voltage can thus be automatically regulated. The voltage of the dry battery being equal to that of the storage battery when fully charged, if on return the storage battery voltage is inferior to that of the dry cells, the latter send current into the storage cells. When the voltage is restored the dry cells cease discharging and tend to depolarize. Hence, the storage cells work continually under the most favorable conditions, receiving and discharging in small quantities.

Heavy Motor Wagons for Liverpool Traffic.

This paper is intended to consider the question of heavy motor wagons as applied to Liverpool traffic, and does not purpose to go further than that, although it will apply to similar traffic elsewhere. My firm have been engaged in experimenting and constructing a suitable wagon for about two years, have spent a considerable amount of time and money over the problem, with, at last, we believe, a considerable amount of success, and it is my intention to-night to tell you first what our experience has taught us is required to make an ideal wagon, to describe to you what we have done, and then to leave you to form your own opinion as to how far we have succeeded. The problem has been to make a motor wagon, having a tare of 3 tons, to carry loads varying from 5 to 10 tons.

You will see that several important parts of the general design are practicaly settled for us if the motor wagon is to be of any use in Liverpool, and in my opinion they are:

(1) The platform must have a loading area as large as any we have seen, or the weight of goods cannot be carried.

(2) The top of the wagon must be entirely independent of the machinery to allow it to sag, because, if made strong and stiff enough to prevent sagging, the wagon becomes too heavy.

(3) There must be no chimney, and no sparks, or else cotton and other inflammable goods cannot be carried.

(4) There must be no cab in front, except a small driver's seat, or long material cannot be caried, and with the large platform area required an additional 4 ft. to 6 ft. in front for boiler and engine would make the wagon unwieldy.

(5) The last really means that the engine, boiler and machinery must be carried entirely below the platform.

(6) The wagon must carry enough fuel and water to travel at least 15 miles.

(7) The platform must be made of the same material and in the same was as the horse wagons, if we are to take any account of the years of experience gained by the Liverpool team owners in handling the goods, and consider the present design to be the survival of the fittest, as regards first cost, wear and maintenance.

Having now settled the general design of the wagon, I will now proceed to consider the machinery in general and in detail. Looking at the case generally, I think it is absolutely necessary that the motive power should be steam and the fuel petroleum, or petroleum refuse; also that for an ideal wagon the steam should be made automatically, as required, or, in other words, the supply of fuel and water should be automatically governed by the required pressure and quantity of steam necessary to carry out the work it may be called upon to do, independent of the driver. Another important feature is that the driver should be able to leave his wagon for at least half an hour without attention, knowing that while he was loading or unloading it the machinery and boiler could be left to itself, yet be ready for immediate use without fear of burning or bursting his boiler, or having no steam at all. The above being accomplished, it leaves the driver his combined starting and reversing lever and his steering and brake wheels to attend to, or, when running, practically only his steering wheel and reversing lever.

Taking the boiler in detail, what is required is a boiler that will be safe when red hot; safe when with undue pressure; safe even if it does explode; can be forced to double its normal working power in a few minutes; must use any kind of water; must have few or no joints; must be cheap; must be light; must be compact; must not scale; must require no chimney; must require little cleaning; the petroleum burner must be capable of burning any kind of oil; must have no small holes to get choked up; must be economical; must be adjustable to burn from one-tenth to its full quantity of oil; must not deposit carbon; must give perfect combustion, and, therefore, no smell; must be noiseless; must burn in any position; must not be blown out with the wind; must be compact, light and cheap.

The engine may be any design, provided it is strong, light, balanced and economical; that it will stand superheated steam and a pressure double the normal working pressure; also that it will work with steam cut off at one-fourth to full stroke and have no link motion. The water pump must be simple and be capable of pumping any kind of dirty water, and, therefore, must have no valves. The oil pump must have no valves; the governing arrangement must be simple and reliable; must deliver the requisite quantity of fuel, water and air as required; must not continue feeding oil to the burner should the water supply fail or pump not act; must not continue feeding water to the boiler should the oil supply fail or pump not act; must be capable of being put out of gear, and the oil, water and air supply regulated up to double the normal quantity from the driver's seat at any moment if required.

As we have followed to a great extent upon beaten tracks as regards steering, brakes and driving gear, I will not enumerate the different points, but simply explain what we have done. I will now have put on the screen, first some view of the wagon and machinery, and then explain to you the general arrangement and details, and may state that we believe and claim to have produced a motor wagon which, if not yet quite perfect, will eventually embody all the features mentioned in this paper.

The steam motor wagons now sold require a wagon driver and a stoker (who attends to the feed water and fire) usually combined in one man. One of the principal features in the Musker system is that the human stoker is replaced by a mechanical one, and the boiler and burner have been specially designed to be worked in that way, although they could also be worked in the ordinary way. The mechanical stoker takes the form of a small auxiliary steam engine, which is always running, driving the water and oil pumps and air fan, and having its speed regulated automatically by the pressure of steam. It must not be thought that this is an extra complication; it simply takes the place of the steam feed pump usually carried, and is quite independent of the main engine.

The oil, water and air for the burner and boiler are all supplied in quantities as required—that is to say, according to the quantity of heat or steam required; and they are supplied in fixed proportional quantities; the variation of quantity supplied being effected and governed by the pressure of steam through the small auxiliary steam engine, driven by steam from the boiler. The whole of the air for burning the oil vapor is supplied by a small centrifugal fan driven by the auxiliary engine. The auxiliary or controlling engine is starting when the wagon is commencing its day's work, and is not stopped until the end. In operation, therefore, if, when running, steam is partly or entirely cut off from the main engine of the wagon, and the pressure of steam in the boiler begins to exceed the normal, or a certain abnormal pressure, this pressure acts through a governor device so as to govern the speed of the controlling engine and regulate the supply of oil, water and air. Thus, when, say, the wagon is at a standstill, only so much oil, water and air will be supplied as will keep the necessary amount and pressure of the steam in the boiler, normally required to make up for condensation, waste and driving the auxiliary engine—that is to say, without generating too much or allowing a diminution of pressure or quantity.

The wagon is very similar to the ordinary horse wagon used on the Liverpool docks for carrying 6 or 7 tons. The platform is made entirely of wood, measures 17 ft. by 6 ft. 6 in. extreme width, and gives an available carrying area for goods of 110.5 sq. ft., less the space taken up by the driver's seat, which in future will be carried on brackets entirely in front. The front wheels are * diameter, and the back driving wheels are * diameter, and all have tires * wide. The front wheels are the steering wheels; they are pivoted on Ackermann's system, and controlled by a bell crank lever and screw. The driving wheels are fitted with ¼-in. thick steel plates, recessed into the inside of the felloes, and well bolted to same. The chain wheels are bolted to these plates, so that the driving power is applied directly to the felloes of the wheels. The cast iron nave bushes have flanges bolted to the naves to prevent them working loose.

The whole of the machinery is attached to a platform constructed of oak, strengthened with thin iron plates, and is supported from the axles by four bolts, one at each corner, fitted with strong spiral springs of a strength to suit the load; these springs also serve to reduce any sudden strain on the machinery when starting quickly. This platform and the machinery carried on it can be removed from under the wagon in about half an hour if any repairs are required, and enables them to be effected in an easy manner. This platform being hung separately from the upper or load-carrying one, is not affected by the latter being bent by the load or twisted by any inequalities of the road.

The burner is at present made of cast iron, and consists of an oil vaporizing chamber, A, an air heating chamber, B, and a nozzle, C, at which the mixture is burnt. The air is forced by the fan at a slight pressure (about 1 in. water pressure) through the heating chamber, which is heated by the flame itself to a temperature sufficient to take up enough oil to form a burning mixture; it then passes through a port into

the oil vaporizing chamber, into which oil is pumped through a 3-16-in. diameter pipe in proportion to the air supplied, which is then vaporized and taken up by the heated air. In order to mix thoroughly the oil vapor and air, it is then passed backward and forward around the burner, and finally through the center of the nozzle. The nozzle consists of a cast iron disk 2 in. thick, having about 120 holes, ⅜ in. diameter, and at the back is fitted with ¼-in. plate, also perforated, fastening a disk of gauze wire over the holes to prevent back firing. Through the center of the burner is fitted a wrought iron pipe, 1½ in. diameter, to allow a lighted taper to be placed in front of the nozzle from the outside of the burner when first starting it. An iron obstruction, of grid pattern, is placed in front of the nozzle to steady the flame, and to deflect some of the heat to the walls of the heating chamber.

The form of burner is the result of a considerable amount of experimenting. It does what has never been done before, and, we are informed, is a very good patent, and, needless to say, is patented. It gives perfect combustion, and as no more air is supplied than what is required for combustion, the oil is burned in the most economical manner. There is no smell, it is almost noiseless, and, if necessary, can be made quite noiseless; it can be made to burn from one-tenth to the full quantity of oil instantly, or vice versa, and will burn about 200 lbs. of oil per square foot of nozzle or grate area. The flame, being pure, deposits no soot or carbon, and does not injure the boiler tubes. The burner will work in any position, and, as all the air is supplied at a slight pressure, no chimney, as with natural draught, is required. There is no carbon or other deposit inside the burner, as all the oil is taken up. Any kind of refined or crude oil can be used, as there are no parts to be choked up.

The boiler consists of about 270 ft. of solid drawn weldless steel piping, 1 1-16 in. outside diameter and ⅝ in. bore, made into three concentric coils. The two center coils are made with the rings slightly apart, for the flame or heat to pass through, the outer has the rings coiled closely together, to prevent the heat escaping, except at the end, and the outside is lagged with asbestos sheets and sheet iron. The ends of the two inner coils are stopped with asbestos and the heat passes from the burner, which is attached to the outer coil, between and around the rings of the two inner coils, along between the outer and middle coils, and out at the end furthest away from the burner. The coils are joined together by steel unions at the back of the boiler. The water is pumped into the outer coil at the back, furthest from the burner, and in its passage through the whole length is turned into saturated steam, and, finally, before leaving, into superheated steam. There is no priming, because the proportions of water and heat are regulated, and because the water and steam pass through a heat which continues increasing until the steam leaves the boiler. The boiler has been red hot while under a steam pressure of 400 lbs. per square inch, and on one occasion, when fitted with gun metal unions, one burst with 400 lbs. pressure, without doing the slightest damage except to the union.

There is no deposit or scale inside the tubes, as the scouring action due to the rapid rush of steam is very great, and also because the rings of the coils are always altering slightly in form, owing to the changes of pressure and temperature. The boiler can be forced to double its normal steaming capabilities, and also to double its working pressure, without doing it the slightest injury. The exhaust steam from the engines is passed into the flue at the back of the boiler, is superheated by the waste heat, and the gases and steam pass invisible to the atmosphere, the outlet of the flue being close to the ground.

The main engine is high-pressure, single-acting, having four cylinders, 5 in. diameter by 4 in. stroke, arranged in two pairs, each pair being set at an angle of 90 deg. to the other. The crank shaft has two crank pins set opposite, and each pin has two connecting rods working on it and held by a fitting similar to those used on the "Brotherhood" engines. The steam is admitted to the cylinders by lift valves, one to each cylinder, and the exhaust is controlled by two piston valves, one to each pair of cylinders. The valves are actuated by cams fitted on a shaft driven by spur gearing from the crank shaft.

For reversing or changing the cut-off, the shaft is moved along the bearing so as to bring into use a fresh set of cams, and they are arranged to give a quarter and three-quarter cut-off on the forward movement of the wagon, and three-quarter cut-off on the backward movement, and also arranged to give an intermediate position, so that all the steam admission valves are closed at the same time, the reversing lever acting as a stop valve in addition to the ordinary stop valve. The engine shown has six valves, but future engines will have only four. A pinion wheel fitted on the end of the crank shaft gears into the spur wheel of the differential gear fitted to the second motion shaft, the ratio being 2 to 1; the driving chain pinions are fitted on the ends of the second motion shaft, and wagon driving wheels are driven from these by means of Reynolds' patent silent chains. The engine runs at 420 revolutions per minute to drive the wagon 5 miles per hour.

The auxiliary engine, for pumping the feed water, oil and air to the burner, is single-acting, having one cylinder, 2½ in. diameter by 2 in. stroke; it is fitted with a cam-lifted valve for the steam, and it exhausts through a port in the cylinder walls when the piston uncovers it at seven-eighths of the stroke. The fly wheel has teeth on the rim driving the centrifugal fan through a pinion wheel on the shaft, driving also an additional shaft, upon which is fitted the automatic governor. The crank shaft also drives the feed water and oil pumps through a separate shaft. The cam for lifting the valve is fitted on a sleeve working on a feather on the crank shaft, and, according to its position, cuts off the steam from three-quarters cut-off to no steam. This movement is obtained from the governor, which is also governed by the pressure of steam, acting on the diaphragm; thus, if the pressure exceeds its normal the diaphragm moves a lever, which fixes the position of the balls on the governor arms, so that the engine runs at the minimum speed required to keep just sufficient water, oil and air supplied to keep the normal pressure on the boiler.

Immediately the pressure of steam falls below the normal, the diaphragm ceases to act, the governor balls resume their original position, the cam sleeve is moved so that ample steam is given to the engine to drive it at the speed requisite to supply water, oil and air sufficient to make steam to supply the demand. Should the boiler be required to supply extra steam at a higher pressure the governor is held in by a foot lever at the driver's seat. The water and oil pumps are valveless, the ports being opened and closed by the movement given to them by the crank shaft. They have not given the slightest trouble and do not require any attention.

A double steam safety valve is fitted on the steam pipe between the stop valve and boiler, and is set to blow off at 500 lbs. per square inch, and an additional water safety valve is fitted between the pumps and the boiler, set to return the water to the tank at 450 lbs. pressure, so that no further water can

be forced into the boiler beyond that pressure, and therefore no more steam made. A band brake is fitted to the second motion shaft and an emergency brake to the driving wheels, and, as the engine can be reversed, a third brake is available.

In ordinary running, one steering wheel, one reversing lever and one stop valve handle are all that require attention, and, as the reversing lever acts as a stop valve and as a brake, practically only the steering requires attention. A pressure gauge is fitted at the driver's seat for observation, but does not require to be watched, as the pressure governor attends to the requirements of the boiler. The oil tank holds about 24 gallons, which is sufficient for a day's run. The water tanks have a capacity of about 144 gals. sufficient for a full half day's working.

In starting to get up steam, about one-half pint of methylated spirits is poured into the tray under the burner casing; this is allowed to burn for about 15 minutes; a torch is then inserted through the lighting and observation hole in the center of the burner. A handle is now fitted on the end of the pump crank shaft and turned for about five minutes, when sufficient steam will have been generated in the boiler to drive the auxiliary engine; the handle is then removed and the engine goes on working at full speed until the steam pressure reaches the normal, when it slows down until the wagon is started. After this the supply of water, oil and air is automatically governed and requires no further attention.

When the wagon is not required for further use, the auxiliary engine stop valve is shut, and the wagon is left until again required. Should the water supply fail, the auxiliary engine will use up the small quantity of steam in the boiler and then stop. Should the oil supply fail, the engine stops for the same reason, as no further steam is generated after the burner ceases to work. In neither case is there any damage done to the boiler. The water and oil pumps are proportioned in the ratio of 15 to 1 by weight—that is, 1 lb. of oil is supplied to evaporate 15 lbs. of water, to superheat the steam before being used in the engines, and to superheat the exhaust steam to make it invisible.

The boiler fitted on the wagon shown will evaporate about 17 lbs. of water from and at 212 deg F. with 1 lb. of ordinary petroleum. The auxiliary engine uses about 15 lbs. of steam per hour when running at its usual working speed. The normal working steam pressure is 250 lbs. per square inch, and the steam is superheated to 600 deg. F.

The wagon shown is entirely an experimental one, and will be considerably improved and simplified. It has, however, been run most successfully, and will carry 6 tons at a speed of 5 miles an hour on the level. The tare is just under 3 tons. As the boiler and engine can be worked to double their power when required, the necessity for two-speed gearing for climbing hills is obviated, and simplifies the wagon considerably.—Automotor Journal.

The Thor Roller Bearing.

Among the many new roller bearings now coming onto the market in anticipation of a growing demand from makers of motor vehicles, is the Thor, made by the Aurora Automatic Machinery Co., Aurora, Ill.

In the Thor roller bearing there are two distinct elements combined, or two bearings, namely, vertical and horizontal load.

First—The rollers, being on a horizontal axis carry the vertical load, each roller touching the inner and outer bearing surface in diametrically opposite points.

Second—The balls, acting only in the capacity of end thrust, act between two parallel disks, also touching the same at diametrically opposite points, and in no way interfering with the horizontal carrying capacity of the hub.

It is further claimed that on account of the short roller in proportion to the diameter, very little room is taken up laterally in the hub, and the bearing points consequently come much further apart than in the ball bearing.

Other advantages claimed are the comparatively large size of rollers, which consequently are less in number (making separators, which are generally frail at the best, unnecessary) and running at much less speed than balls on account of their size, thereby also reducing friction, and the fact that the rollers are bored through the center gives them a certain amount of flexibility which is favorable to the wear of the bearing.

We illustrate the Thor bearing as used in an automobile hub designed for wooden wheels. The two telescopic shells are pressed together inclosing the wooden center. The telescopic shell remains permanent with the wheel, with the cups pressed into the same. The cones fit the regular axles of taper construction and are connected with a sleeve, which is screwed up tight at both ends, one fitting the outer and one the inner cone. This gives the lateral adjustment once for all, and when the wheel is taken off the shaft, the inside construction, consisting of two cones, the rollers and the sleeve, follow the wheel. In this way it exposes nearly one-half of each roller, making it easily accessible for cleaning and inspecting, and still retaining the rollers.

They also apply the bearing to the regular bent spoke, direct or tangent wire wheel, suitable for front automobile hubs. If necessary, a suitable device for fastening driving gear for rear drive wheels may be added.

MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 641,313—Motor Vehicle.—Andrew J. Martin, Buffalo, N. Y. Application filed Jan. 13, 1899.

The objects of the invention are, first, to provide for readily and easily effecting a change in the speed of the vehicle without interfering with the operating mechanism—that is, the driving power will always remain the same, although the speed may be varied; and, secondly, to avoid any jarring or unevenness of operation consequent upon increasing the speed of the vehicle.

The first object the inventor endeavors to accomplish by providing the fly wheel of a crank shaft with a shiftable crank pin, which has its bearing in said wheel, and is capable of being moved away from and toward the axial center of said wheel. This crank pin is mounted on a threaded shaft, which is located diametrically within the fly wheel. By rotating this shaft the crank pin will be moved either toward the periphery of the wheel or toward the axial center of the latter. This rotation of the shaft may be effected in any desired way while the wheel is in motion.

The second object of the invention is said to be accomplished by providing a counterweight, which is also movable back and forth on the shaft. This shaft has right and left hand screw-threads extending from the center of the wheel to the ends of the shaft. As the crank pin is caused to travel in one direction by the rotation of the shaft, the counterweight moves in the opposite direction relative to the axial center of the wheel.

In the accompanying drawings, Fig. 1 is a side elevation showing clutch and fly wheel. Fig. 2 is a plan view. Fig. 3 is a vertical sectional view on the line 3 3, Fig. 1. Fig 4 is a transverse sectional view of the fly wheel. Figs. 5 and 6 are enlarged views of one of the clutch arms and adjuncts. Fig. 7 is a view of the cam plate detached. Fig. 8 is a bottom plan view of one of the clutch shoe plates.

Referring to the drawings, A designates a fly wheel and a a crank shaft, upon which said wheel is axially mounted, said shaft fitting in a hub or boss, a′, on one side of the wheel at the center thereof. Within this wheel is a diametrical bore, a^2, which extends to near the periphery and opens through one side of the wheel, forming a slot, a^3.

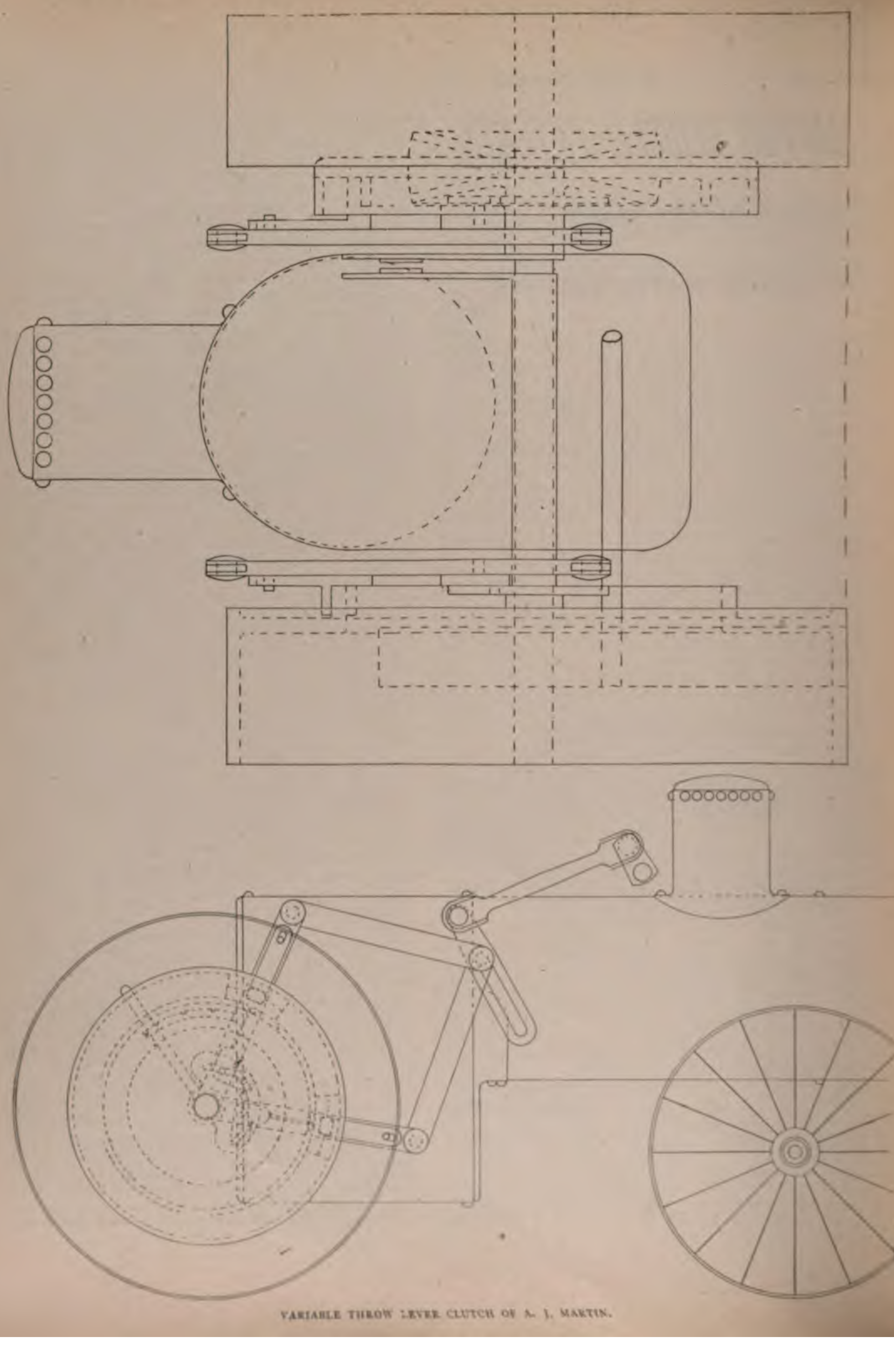
B is a crank pin and b the base block thereof, fitted so as to slide in slot a^3. This block has a threaded bore to accommodate the thread b′ of a shaft, b^2, extending longitudinally within bore a^2. This shaft is held in place by apertured lugs, b^{2x}, of one side of the wheel. The shaft b^2 may be rotated according as it is desired to increase or lessen the speed of the vehicle, by any suitable means, it being only necessary to turn such shaft sufficiently to locate the crank pin at the desired point relative to the axial center of the wheel. The means shown embraces a beveled pinion, b^3, which meshes with a second beveled pinion, b^4, whose shaft, b^5, is mounted in wheel A at right angles to shaft b^2. The outer end of this shaft projects beyond the inner side of wheel A and has keyed thereon a wheel b^6. By turning this wheel and its shaft the rotation of the shaft b^2 is effected. In this way the crank pin and its block will be caused to travel back and forth in the slot a^3, thereby positioning the same nearer to or further away from the center of the fly wheel, according as it is desired to lessen the speed at the gain of power or increase the speed at the cost of power.

The shaft b^2 is formed with right and left hand threads, the crank pin block being in engagement with the former, while on the latter thread is a counterbalancing weight, C. This weight is also movable within the bore a^2 on the other side of the center of the wheel from the crank pin. The latter and the weight always travel synchronously toward or away from the wheel center, the weight serving to counterbalance the positioning of the crank pin and avoiding the jarring consequent upon the pin being moved away from the axial center of the wheel.

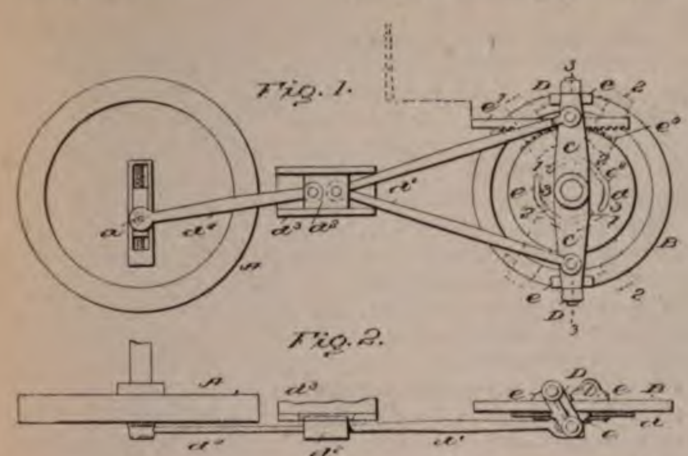
The wheel b^6 is shown as having a V-shaped periphery. Two upright curved bars, d d′, carried by a horizontally movable slide, d^2, are provided with V-grooves to accommodate the periphery of the wheel b^6. The bars d d′ are so spaced apart that the wheel b^6 may travel between them without contact; but when the slide is moved, one bar or the other will be in line to be engaged by the wheel b^6. Thus, the latter will be turned, the direction being governed according as the contact is with the bar d or d′. In this way the shifting of the crank pin and counterweight is effected. The slide d^2 may be moved by any suitable means.

D is the clutch wheel, which in practice is keyed on a rotary bearing or sleeve d^x, on which is keyed one of the carrying wheels (not shown). The rear carrying wheels are preferably those to which the clutch wheels are thus secured through the intermediary of the sleeve.

E E are two clutch arms, and e is a cam disk, loose on d^x. The arms E are extended, one upward and the other downward. At their inner ends they are loosely mounted on sleeve d^x and are both connected by two toggles, e^2, to a crosshead, e^3, which is guided by a plate, e^x. To the crosshead e^3 is secured one end of a pitman, e^4, loose at its other end on crank pin B. To the outer end of each arm E is pivotally secured one end of a plate, F. Both of these plates extend transversely over the periphery of wheel D, and each carries two centrally pivoted shoes, f, which face the opposite flat faces of wheel D, with which, when the plates F are thrown off a straight line—that is, set obliquely to the periphery of the wheel—they engage so as to firmly bite the sides of the wheel. The inner faces of these shoes are consequently made to conform to the engaging faces on the sides of the wheel. The shoes have a prying-like action against the sides of the wheel, and when the carrying arm is moved in the direction in which the plate is set, the shoes will bite like a vise against the wheel and cause the latter to rotate with the arms. Yet on the recovery stroke of each arm the wheel will not be interfered with by the shoes. The two carrying arms act alternately to effect the rotation of the clutch wheel—that is, as one arm is on its recovery stroke the wheel is being rotated by the other arm, the shoes of the former allowing the wheel to pass between them without frictional contact. The direction of rotation of wheel D is controlled by the position in which the shoe-carrying plates F are set obliquely—that is, when the upper plate is thrown with its extremity rearward, and the lower plate with its extremity forward, the wheel D

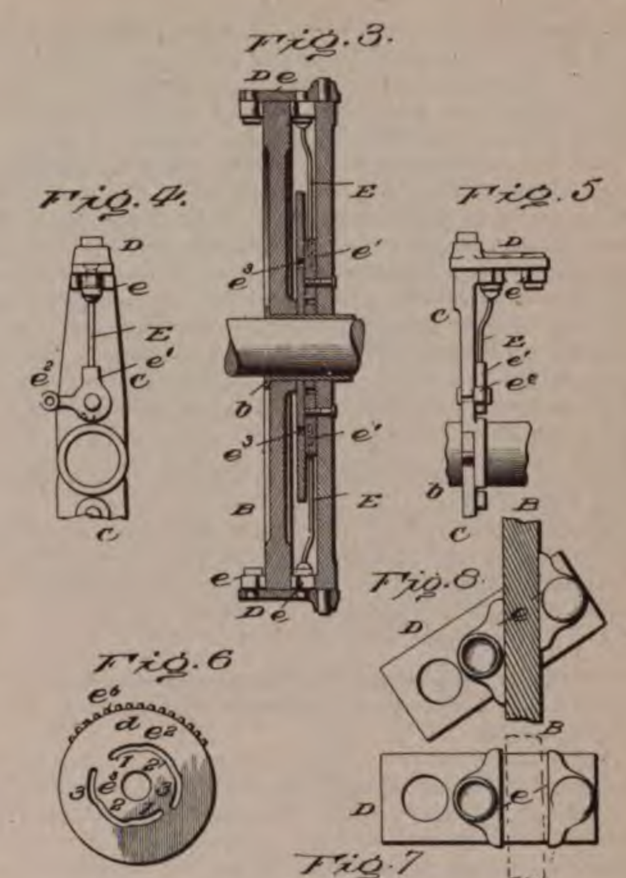


VARIABLE THROW LEVER CLUTCH OF A. J. MARTIN.



will be rotated in the forward direction, while it will be moved rearward when the positions of the upper and lower plates are reversed. The two arms E E are operated synchronously, while their clutch shoes act on the wheel D successively—that is, while the clutch shoes of one arm are gripping the wheel, the shoes of the other arm are slipping. For instance, to obtain a forward movement of the wheel D, and, consequently the vehicle, both of the arms E will be forced as far to the rear as possible (see position indicated by dotted lines 2, Fig. 1), and the plate F of the upper arm is caused to lie obliquely across the face of the wheel with its extreme end pointing forward, while the plate F of the lower arm is positioned with its extreme end pointing forward. The crank pin being started to the rear, both of the arms E must follow, and the wheel D also, since the shoes of the plate F of the upper arm have the grip and the plate F of the lower arm is slipping. When the half revolution of the fly wheel is completed and the arms E start on the rearward movement, the shoes of the plate of the lower arm will grip the wheel D, while those of the upper arm are slipping. In this way the wheel D is being continuously revolved, the clutch shoes of one arm acting to pull the wheel and those of the other to push it; but when these plates are set on a straight line extended directly across the periphery of the wheel, the shoes will not engage the latter in the reciprocal movements of their carrying arms.

G G designate two spring rods having outer rounded ends fitted in sockets in the inner shoes—that is, those adjoining the pivoted ends of the plates F. Each of these spring rods projects from a lever, g, mounted on the inner end of each arm E, and having a lateral extension, g', which fits in a slot, g^2, of cam disk e. There are two such slots in this cam disk, and each slot is composed of three sections—a central section, g^3, and two end sections, g^4 g^5. These three sections are concentric with the axis of the disk, but are all on different radii—that is, the radius of the section g^4 is less than that of the central section g^3, while the radius of the other end section g^5 is greater than that of the other sections. The end sections open angularly into the central section. It is by adjusting this disk that the shoe-carrying plates are shifted—that is, when the disk is so set that the extensions g' of the two levers g will travel in the central sections g^3 of the upper and lower slots, the plates F will extend straight across the periphery of the wheel D; but when the disk is turned so as to throw, say, the end sections g^4 into line with the extensions g', the plates F will be set so as to rotate the wheel D forward. The



arc of each section of each slot controls the radius of movement of the lateral projections g' of each lever g. The positions of the shoe-carrying plates will not be altered or disturbed save when the disk is itself turned axially. Hence, by shifting the disk e, the direction of travel of the vehicle may be reversed or the wheels, as on a downward grade, may be allowed to rotate without aid or hindrance from the clutch arms.

The means for shifting the cam disk may be of any preferred form or kind. Here are shown segmental rack teeth, g^6, in the periphery, with which a rack bar, g^7, may engage for this purpose.

In practice the operator can at pleasure regulate the speed of the vehicle. By any suitable connection the slide d^3 may be shifted so as to throw either one of the contact bars d d' in line to be engaged by the wheel b^6. As this occurs, the screw shaft is rotated each time the wheel b^6 engages with such bar d or d'. When the desired speed is obtained, the slide is moved so that the wheel b^6 will pass between the bars d d' without contacting with either. The cam disk e is positioned so that one end section of each slot will be brought into line with the lateral projection of the levers g. This will, through the rods G G, effect the setting of the two plates F obliquely across the periphery of the clutch wheel. The revolution of the fly wheel will cause the reciprocation of the arms E. Each of these is moved in the direction in which the shoe-carrying plates are set, the shoes will firmly grip against the flat sides of the clutch wheel and cause the rotation of the latter. As the clutch shoes of one arm are thus acting on the clutch wheel, those of the complimentary arm, which is on

the recovery stroke, are sliding, the wheel passing between them without impediment. By thus causing the clutch shoes to bind against the engaging surfaces on opposite sides of the clutch wheel, it is claimed, the danger of slipping is avoided and a firm grip is secured at each operation.

The bite of the shoes of each clutch arm being when the arm is moved in the direction in which the clutch wheel is being rotated, such wheel can, under certain conditions, move at an accelerated speed—that is, faster than the movement of the clutch arm. For instance, in turning the vehicle the carrying wheel describing the outer circle will, together with the clutch wheel fixedly connected therewith, travel faster than the clutch arms. The clutch wheel will then be free to slide or pass between the clutch shoes, the latter not in any way interfering with this increased or accelerated speed of the clutch wheel.

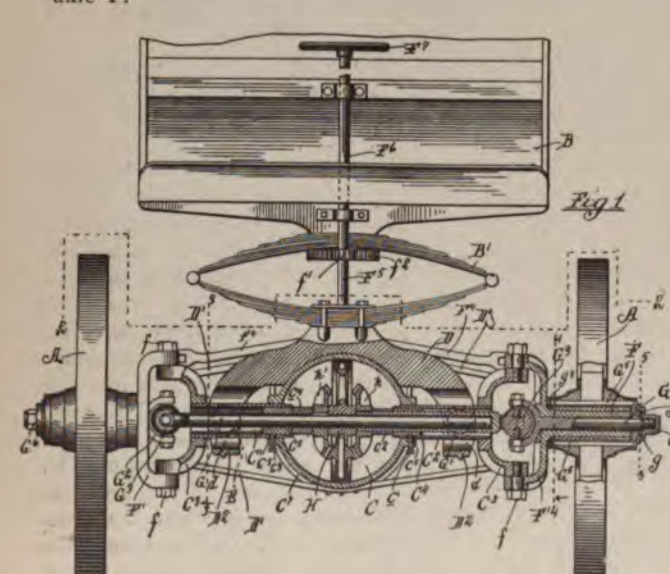
No. 641,404—Jan. 16, 1900—Motor Carriage.—W. E. Pearson, Boston, Mass.

This invention relates to a method of suspending the motor by swinging links and hinged joints in such a way that the carriage and the motor will be independent of each other so far as shocks and vibrations are concerned.

Two claims. Application filed Nov. 4, 1899.

No. 641,511—Jan. 16, 1900—Driving and Steering Apparatus for Motor Vehicles.—Chas. T. Hildebrandt and F. R. McMullin, Chicago, Ill.

Fig. 1 is a front view, partly in section, of the combined steering and driving wheels. The casing C is conveniently constructed to inclose the differential gear mechanism, and is provided on one or both ends with removable covers, C^6, shaped to conform to the inclosed parts. The universal joints G^3 are shown consisting of divergent fork arms, pivoted to a ball-shaped body interposed between and embraced by the same, said pivot being arranged in two different planes at right angles to each other. The pivots of said universal joints are therefore located centrally of the fork arms C^5 and F′ and are in the same vertical plane with and enable the shaft section G^2 to swing about the same center of oscillation as the stub axle F.



It will be seen that the shaft, made up of the four parts, has but four bearing points or sleeves—namely, the bushings C^4 and C^5 and the tubular stub axles F—and that they are out of bearing contact with the parts of the frame at other points.

The means for driving the wheels A from the shaft are constructed as follows: The outer parts G^2 of shaft sections of said driving shaft extend outwardly through and have bearing within the tubular stub axles F. Each shaft section projects some distance outside of the stub axles, and upon said projecting part of the shaft is mounted a ring or washer, g, which is secured to the shaft by means preventing rotation, as, for instance, by keys, and forms, in effect, a flange on said shaft section. Said ring fits closely against the outer end of the stub axle and is provided radially outside of said stub axle with a circular series of bolt apertures, and through said apertures and longitudinal apertures in the hub are passed a plurality of screws or bolts, G^3. The hub will desirably be made of wood and bored to permit the passage of said bolts therethrough. Said bolts are screw-threaded at their inner ends and engage screw-threaded apertures in a ring or washer, g^3, interposed between the rear end of the hub and the fork arms F′ of the stub axle F. Said ring or washer is interiorly conformed to the shape of the adjacent faces of the fork arms, as shown in Fig. 1, so as to fit closely against the same. The outer end of the shaft section G^2 is screw-threaded and provided with a lock nut, G^4, by means of which the wheel hub is held in place. With this construction power from the driving shaft is communicated through the shaft section G^2 to the ring or washer g, and by means of the bolts G^3 to the wheel hub.

The driving or steering device herein described is constructed to swing on a horizontal pivot located centrally of the front end of the wagon, so that when one of the steering wheels passes over an elevation it will not twist the wagon body or running gear frame. Such horizontal pivot consists in the present instance of the cylindric casing C. The construction by which this result is secured is as follows: The tubular sections C^5 are rigidly attached to the casing or drum C, so that when either end of the frame is thrown upwardly by one of the wheels passing over an elevation, said drum will be caused to rotate upon its axis. The bearing block D is not attached rigidly to the casing, so that when said casing is thus partially rotated it turns upon said bearing block without giving motion to the latter. Said bearing block is held from rising by means of suitable bands, C^7, which embrace the under surface of the opposite ends of the casing and are attached at their upper ends to lugs, c^5, secured rigidly to or made integral with said block D. With this construction, said bearing block D, at the upper side, and the bands C^7, at the lower side, provide a seat within which the casing may be rotated, as one or the other of the wheels A is moved vertically above the other one. The depending arms D^3 of the bearing block are provided with slots, d, as shown more clearly in Fig. 1, through which the tubular sections C′ and C^5 pass, and which afford room for the vertical oscillations of said parts.

A main or principal feature of the invention is embodied in the construction wherein the stub axles F are provided with inwardly extending fork arms, which are pivoted to outwardly extending fork arms on the frame, and a rotary driving shaft, each half of which consists of two parts connected by a universal joint, which is located centrally of and in the same vertical plane as the pivotal connection between the axle section and frame, and in which the outer part of said shaft is connected with and drives the wheel mounted on said stub axle.

Eight claims. Application filed Jan. 9, 1899.

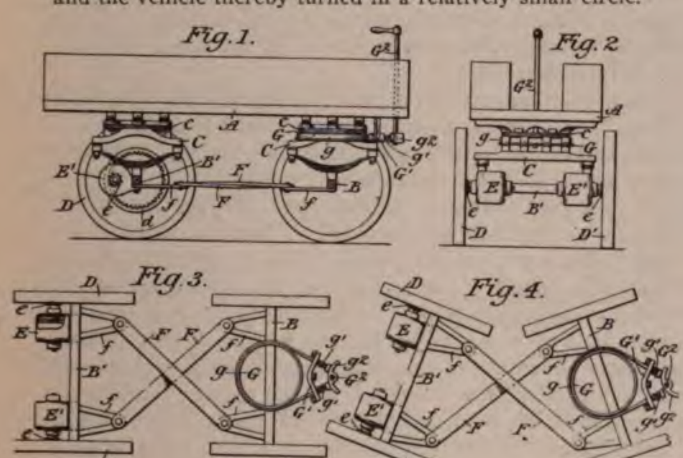
No. 641,659—Jan. 16, 1900—Explosive Engine.—G. A. Tuerk, Chicago, Ill.

The proposed improvement consists in a simple exhaust valve gear, as well as means to cut out the igniting mechanism when the engine is running light.

Nine claims. Application filed March 25, 1899.

No. 641,514—Jan. 16, 1900—Motor Vehicle.—C. W. Hunt, New York, N. Y.

In accordance with the invention, two, at least, of the vehicle wheels are driven by independent means, with provisions for retarding or accelerating the motion of one of the wheels relatively to the other, so that the vehicle is directed to one side or the other, as the case may be, means being also provided for retarding or checking the swinging of the wheels. In practice, both axles of a four-wheeled vehicle are preferably mounted to swing in substantially horizontal planes about vertical axes, and are connected by links, so that displacement of one axle in a horizontal plane is transmitted to the other, and the vehicle thereby turned in a relatively small circle.



In the accompanying drawings, Fig. 1 is a view in side elevation, with the near wheels removed and the axles in section. Fig. 2 is a rear end elevation of the vehicle shown in Fig. 1. Fig 3 is a plan view showing the wheels and axles, with their co-operating parts. Fig. 4 is a similar view, but with the parts in different positions.

As represented in Figs. 1 and 2 of the drawings, a suitable spring frame, C, is secured to each of the axles B B′ and receives the weight of the body through a suitable ring or fifth wheel, as indicated at c, a pivot being provided, as usual, about which the axle or the axle with the spring frame is free to swing in a substantially horizontal plane. Each of the wheels D D′ on the axle B′ is arranged to be driven independently of the other by a driving means, such as an electric motor E or E′, any suitable intermediate mechanism being provided, such as the gear d, secured to the vehicle wheel and engaged by a pinion, e, connected to the rotating part of the motor. The driving means for each wheel is controllable independently of the other by any suitable means, so that each wheel can be driven independently of the other and its speed accelerated or retarded relatively, according to the direction in which it is desired to have the vehicle move. When the axle, which in the arrangement shown in Figs. 1, 2, 3 and 4 extends from side to side and has journaled thereon the independently driven wheels, is mounted to swing in a substantially horizontal plane, as also indicated in said figures, the other axle B is also preferably mounted to swing in a substantially horizontal plane and is connected with the axle B′ either directly or through the driving mechanism, or otherwise, so that the diagonally opposite wheels swing together, but in opposite directions, and thereby facilitate the turning of the vehicle in a small circle. As a convenient means for connecting the two axles, links, F, may be employed, as shown in the drawings, such links being preferably pivoted on bracket arms, f, secured to the axles B and B′, so that such links shall be always tangent to the arc of a circle described about the center of oscillation of each axle, and the free movement of the parts shall not be interfered with at any point in their oscillation.

Four claims. Application filed Aug. 10, 1899.

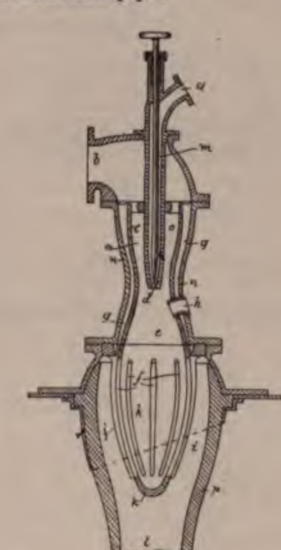
No. 641,369—Jan. 16, 1900—Liquid Fuel Burner.—Oscar Brunler, Eilenburg, Germany.

The object of the invention is to construct a form of burner in which the highest temperature will be attained far enough above the vaporizer to insure the keeping of the latter. The air enters partly below the vaporizer and partly above. The slow-burning gases are then conducted through holes in the vaporizer into the burner head, where the highest temperature will be attained.

One claim. Application filed Nov. 15, 1898.

No. 641,368—Jan. 16, 1900—Burner.—O. Brunler, Eilenburg, Germany.

a is the feed pipe for the liquid, gaseous or pulverized fuel. b is the air introduction pipe.



The fuel feed pipe a runs out into a nozzle, d, the opening of which can be closed more or less, according to the amount of fuel to pass out of it, by the cylindrical rod m being raised or lowered within the said pipe a and nozzle d. The nozzle d is surrounded by a hollow, somewhat cone-shaped casing or mantle c, and this latter is surrounded by the mantle n. Between the nozzle and the mantle c, and between this latter and the outer mantle n, annular spaces, o and g, respectively, are formed, through which the air entering through pipe b can freely pass. The casing or mantle c runs out into a bulb-shaped casing, k, being provided with a number of elongated slots, f, and ribs, f′. The annular space i, formed between this casing and the outer wall p of the apparatus, is in communication with the annular space g. At the constricted portion of the mantle c a short piece of pipe, h, is provided, giving access from without to the interior of the igniting chamber e.

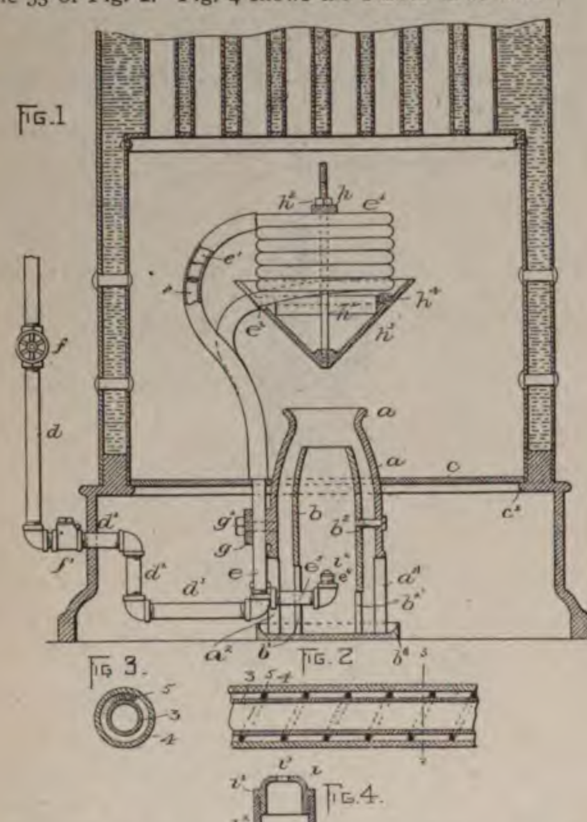
For starting ignition the flame of a soldering lamp or a gas blast is introduced through the pipe h into the chamber e, with the effect of heating the burner and setting up ignition. After the burner is heated to the desired degree the lamp or gas flame is removed and the pipe h is to be plugged up.

If liquid or pulverized fuel is made use of, pressure air must be introduced through pipe b. Part of the air entering through pipe b may take its course through the annular space g in order to attain the highest temperature in the annular space i, and not within the chamber e. A column of flame will be projected out of the opening l into the compartment not containing or having at least no direct communication with the atmosphere.

One claim. Application filed Oct. 31, 1898.

No. 641,776—Jan. 23, 1900—Hydrocarbon Burner.—A. T. Ingalls, Malden, Mass.

Fig. 1 represents the burner and a furnace in section. Fig. 2 is a section through a portion of the pipe, of which the generator is formed. Fig. 3 is a section of the same on the line 33 of Fig. 2. Fig. 4 shows the burner in section.



The coil e' is supported by the vertical pipes e e^2, and the latter are attached to the casing a by a clamp, g, and set screw, g', passed through the latter into the casing, so that the pipes and the coil are maintained in position.

The vaporizing coil is placed with its axis coincident with the axes of the casings, as illustrated upon the drawings, whereby it is surrounded by the heat generated by the flame. Across the top convolution of the coil is placed a supporting bar, h, through which is loosely passed a rod, h', threaded at its upper end to receive a nut, h^2, which rests upon the bar h. The lower end of the rod is likewise threaded to extend into the apex of a conical flame deflector, h^3, placed beneath the coil in an inverted position and having its edges extending beyond the coil. Within the deflector is placed a circular trough, h^4, in which is placed oakum or felt, which is saturated with naphtha or kerosene to initially generate vapor in the coil.

The pipes e and e^2 are covered with asbestos or other fireproof material, the covering extending from the vaporizing coil to the plate c, the said covering being represented in Fig. 1 as having a portion thereof removed from near the upper portion of the pipe e, and thus showing a portion of said pipe as uncovered. The said pipes e e^2, as well as the pipe forming the coil, are constructed as illustrated in Figs. 2 and 3—that is to say, the pipe has an outer shell, 4, and an inner shell, 3, concentric therewith, so that there is an annular air space between them. To maintain the two shells of the pipe in the concentric relation during the use of the device, as well as during the bending of the pipes, a wire, 5, of the proper cross diameter, is wrapped spirally around the inner tube or shell, and the outer tube or shell is slipped over them. Then the pipe can be coiled without disturbing the relation of the shells, and said relation cannot be altered during the use of the device, as by any warping or distortion of the coils when subjected to intense heat.

The burner consists of a thimble or nipple, i, having a radial flange, i, and threaded, so as to be screwed into the tube i'. In the end of the thimble is a contracted opening, i^2, through which the vaporized hydrocarbon is emitted.

To light the apparatus, the hydrocarbon is allowed to flow into the coil, and a small amount of naphtha, kerosene, or other inflammable fluid is placed in the trough h^4 in the deflector and ignited. After a minute or two the vaporizing coil becomes sufficiently heated to vaporize the liquid, and the vapor flows through the burner and is ignited with a match or torch. Combustion immediately takes place in the combustion chamber, and the flame gushes upward through the contracted mouth or throat of the outer casing, and is divided by the deflector, a sufficient quantity of oxygen being supplied to the combustion chamber through the inlets b' b', and to the chamber in the fire box through the inlets a^2 a^2, and the annular chamber surrounding the combustion chamber. The heat generated by the flame is intense, and the hydrocarbon is vaporized immediately upon entering the coil e'; but although the heat in the fire box is intense, as said, the hydrocarbon is not coked in the pipes, since it is protected by the annular air space between the two shells of the pipe, and consequently the flow of the vapor is constant and uniform, and the pressure thereof is practically unvarying.

The deflector may be adjusted vertically to spread the flame more or less, according to the number of tubes in the boiler, by screwing the nut upon the pendent rod. The pan in the ash pit catches the drop from the burner when the valve is first opened, and before the vapor is generated, whereby the hydrocarbon is prevented from spreading over the floor of the ash pit.

Three claims. Application filed March 21, 1898.

No. 641,878—Jan. 23, 1900—Motor Car.—C. A. A. Mongredien and F. D. Bernier, France.

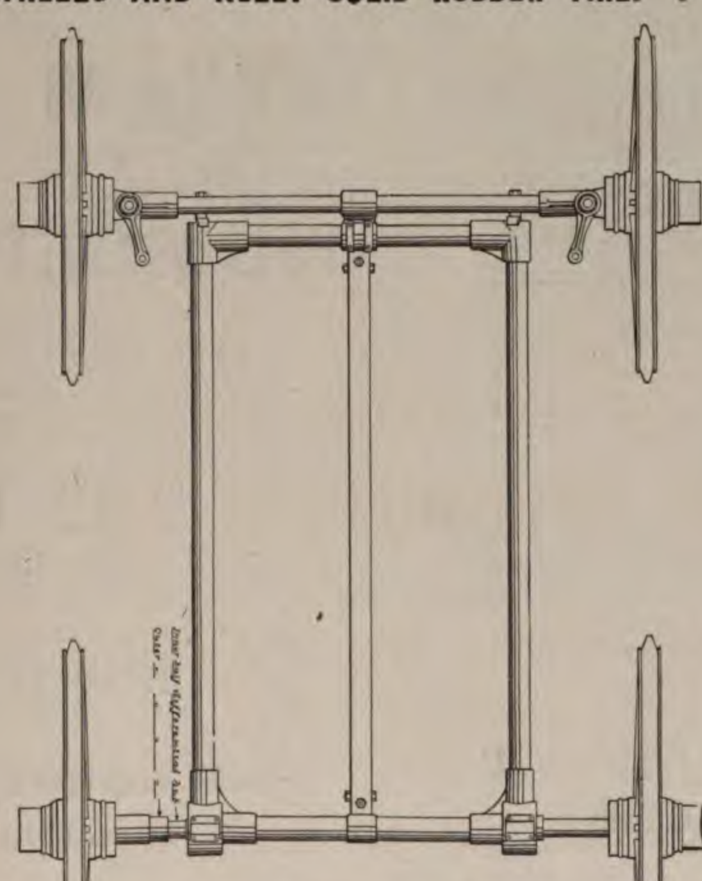
This is a five-wheeled carriage, having a jointed frame, with three axes of rotation to adjust the contrivance to the inequalities of the road. The gearing is composed of bevel gears of different diameters on two parallel shafts, with an intermediate shaft arranged in the same plane, and having on the latter a movable pinion to engage successively with the bevel gears.

Six claims. Application filed Nov. 21, 1898.

THE GRANT ROLLER BEARING AXLES

Have Proven a Success Wherever Used.
Especially Adapted to Automobiles.

WE CAN FURNISH COMPLETE FRAME, INCLUDING WHEELS AND KELLY SOLID RUBBER TIRE. . .



This Frame is Fitted with our Special Rear Axle Bearings.

WRITE for Illustrated Catalogue giving the Testimony of many of the best Concerns in the Country after Using Grant Bearings.

THE GRANT AXLE & WHEEL CO., SPRINGFIELD, OHIO.

Box 750.

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of THE HORSELESS AGE, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

Subscribers who are willing to act as

LOCAL SUBSCRIPTION AGENTS

for THE HORSELESS AGE, on a commission basis, are requested to communicate with the Editor.

STEAM IS THE BEST POWER FOR AUTOMOBILES

Steam Motor Wagon.

THIS STYLE NOW READY.

OTHER STYLES TO FOLLOW.

THE Carriage illustrated here is one that will satisfy the most critical, for in it is combined the finest carriage work and the best machinist skill and workmanship, and it is the most practical and satisfactory pleasure carriage one can have.

FOR FULL PARTICULARS AND PHOTOGRAPH ADDRESS

STANLEY MANUFACTURING CO.,

No. 117 LINCOLN STREET, BOSTON, MASS.

DIAMOND TIRES...

DIVIDE YOUR ORDERS

WE DESIRE COMPARISON

OUR CONSTRUCTION ORIGINATED WITH US

IMITATORS OFFER INDUCEMENTS IN PRICE

RESULT
WE LEAVE TO YOU

DIAMOND RUBBER COMPANY

AKRON O.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. V. NEW YORK, FEBRUARY 21, 1900. No. 21.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

Forget the Horse.

Four years ago we took occasion to comment on the slavish imitation of horse-vehicle forms by our American designers of motor vehicles. This imitation was particularly noticeable in the height and contracted wheel base of the motor carriages then turned out. Although four years have passed, and considerable road experience has been gained, the same adherence to old forms is observed. This conservation and blindness to the real problem is no longer excusable. Once the horse is discarded he should be banished even from the imagination of the motor vehicle designer if the new conditions of service are to be fully understood. The low, long construction, with strong wheels and framework, safe to run at high speeds and to turn quickly and sharply without discomfort to the occupants, and without danger of upsetting, is the only one suitable for the true type of motor vehicle if you would have it so. Slow-speed vehicles for urban use solely may still adhere to the familiar forms, as the work required of them is not sufficient to reveal the defects of their design, but for high speed, quick manœuvring and general road work, the more stable build is absolutely essential. Time will prove this, and both time and expense will be saved if the truth of it is immediately recognized. The motor machine must skim the ground like a swallow.

Question Department.

We wish to stimulate discussion. We believe our "Communications" and "Questions and Answers" departments are extremely valuable to investigators in this new field, and we earnestly request our readers to make more frequent contributions to both departments. The secrecy and jealousy characteristic of the average inventive mind should be discarded and a more liberal feeling engendered. Interchange of views is beneficial to all. If we open our minds to others we receive as well as give. The successful inventor or manufacturer of to-day cannot live the life of a hermit. He must hold intercourse with his co-workers and keep in touch with the world's best thought in his line. It is by suggestion that our knowledge grows, and much of this suggestion comes from other minds.

Don't Leave Your Motor Unlocked.

Experience is proving the folly of leaving motor carriages in the street without in some way locking the controlling apparatus and preventing mischievous meddling. The other day in New York a careless employee left a steam carriage standing by the curb while he went indoors to transact some business. Steam was up and the engine was reversed. During his absence some small boys investigated the machine and pulled the lever. The machine commenced to back, and, striking an obstruction, turned toward the sidewalk and ran over and seriously injured a pedestrian. The machine was badly wrecked by colliding with a lamp post.

The moral, of course, is plain. All motor vehicles, whatever their motive power, should be provided with locking devices of some kind to prevent just such accidents as this.

No Trust in Structural Material.

Some of our daily newspapers have recently expressed fears that the steel tube trust would monopolize the structural material from which motor vehicles are constructed, and compel builders of automobiles to pay extortionate prices for such supplies. Steel tubing is not the only material which can be advantageously used for motor vehicle frames. Channel and angle steel are also employed, and until the whole steel industry is monopolized, builders of automobiles are not likely to be unduly mulcted for their structural supplies.

The Modern Icarus.

Pennington is flying high again (figuratively speaking). He has revamped his Aerial Mail, Express & Construction Co. at Chicago, Ill., with a capital of $3,000,000. Pennington should remember the awful fate of Icarus, who ventured too near the sun and lost his wings. Pennington's wings will not even bear the light.

We are reliably informed that a suitable license law, drafted by friends of the steam vehicle, is soon to be brought before the Legislature of New York State, and that its passage is considered a foregone conclusion. The bill will be broad and reasonable in its provisions, affording protection to the public and at the same time securing the rights of all competent users of steam vehicles, heavy and light.

It has come to our ears that certain persons have said that in our exposure of fraudulent automobile promotions and illegitimate schemes we were hurting "the business." We admit it. We are hurting it, and we propose to continue to hurt it. It is the business known as "green goods."

Pennington was promoting wood working schemes a few years ago out in Indiana. This sounds strange. His motor schemes never would work.

Referring to the Crouch steam carriage, the Baltimore News says: "The primary principle is the explosion of gasoline and water." This is, indeed, discouraging.

The Jenks Corporation Bill.

Albany, N. Y., Saturday.—Professor Jenks bill relating to trusts, officially known as the "Business Companies act," has been introduced in the Senate by Mr. Brackett and in the Assembly by Mr. Alids. It may be described as an attempt to encourage the incorporation in New York State of trusts, and to provide for their regulation in order to protect investors.

It will leave on the statute books the present law, under which companies can incorporate by the payment of an organization tax of one-eighth of one per cent. Provision is made, however, for a different method of incorporation on the payment of a tax of one-fiftieth of one per cent.

WILL BE FOUGHT BY MACHINE.

The aim of Professor Jenks has been to provide a method by which "great combinations of capital" can be organized in New York if they will subject themselves to publicity. It is reasoned that only reliable and genuine corporations are wanted, and that such corporations would reap a great advantage from having a certificate of solvency and business probity that could not be questioned anywhere.

The bill cannot be passed without a great struggle. It is favored by Governor Roosevelt, but not favored by the Republican organization. The managers of the machine believe no corporation will take advantage of the bill. Besides, they think it would be a bad step in this Presidential year to put on the statute books a law which deliberately recognizes the existence of trusts and invites them to come into New York State and incorporate.

WILL NOT ALTER PRESENT LAW.

Nothing in the Jenks bill will repeal any provisions of existing State laws declaring monopolies and combinations in restraint of trade unlawful. It does provide, however, that any two or more corporations organized under it may consolidate. If a stockholder dissents he may compel the company to buy his stock at a price to be fixed by three appraisers appointed by the courts. One corporation may hold the stock of another.

Each corporation organizing under the Jenks bill is to have one or more bonded auditors, who shall be chosen by the stockholders, but not be directors. Statements as to the business of the company, to be available to the stockholders, are to be prepared by them.

Stockholders may at any time have information regarding salaries paid, and of all contracts in which any officer of the corporation may be interested. Shareholders shall have access to the directors' minutes at the annual meetings. If any stock is issued for consideration other than cash, each share shall have stamped upon its face a statement as to why it was issued.

SHAREHOLDERS MUST PAY THE DEBTS.

Where the whole capital of a corporation shall not have been paid in, and the capital paid is insufficient to satisfy its debts, each stockholder shall be required to pay his proportion of the amount necessary to satisfy the debts.

Under this bill fraudulent organization will be impossible. Prospectuses and advertisements of promoters must state facts which are usually concealed. A promoter is declared to have a fiduciary connection with the company which he is engaged in promoting, and his dealings with the company must be indorsed by the shareholders. Two-thirds of the stockholders must vote in favor of increasing the value of the capital stock. Where a corporation proposes to change its business or create new classes of stock a vote of four-fifths of the stockholders in each class shall be necessary.—New York Herald.

Lead Cab Anglo-American and Autotruck trusts do not want such a bill passed. It would hurt "the business."

J. C. Kingman, of the Locomobile Co. of America, delivered a lecture on steam vehicles before the Automobile Club on Saturday evening, Feb. 17.

LONDON NOTES.

London, Feb. 8.

RESTRICTIONS IN LONDON.

Considerable excitement has prevailed in automobile circles here this week because of the announcement that the city of London Corporation, is drawing up a new series of by-laws with respect to "locomotives," under which such vehicles are to be prohibited to pass along certain streets between the hours of 9 a. m. and 7 p. m., while from a few thoroughfares they are to be debarred altogether. The excitement referred to has been caused by the statement that the term "locomotives" includes motor cars, or light locomotives, this being the legal denomination of automobiles in this country. The city of London authorities are basing their action on the Locomotives Act of 1898; but as in this act it is distinctly stated that "nothing in this act shall affect light locomotives within the meaning of the Locomotives on Highways Act of 1896," they appear to be in the wrong. However, as a result of the attention that has been drawn to the matter this week, the city authorities will find that automobilists are on the qui vive to see that the rights granted under the act of 1896 are not interfered with.

MOTOR VEHICLE USERS' DEFENSE ASSOCIATION.

Not before its time, a motor vehicle users' defense association has just been formed in London for the general protection of motor vehicle users against proceedings or actions at law, either civil or criminal, and, where necessary, to commence proceedings or actions at law, and generally to protect the interests of motor vehicle users throughout the country. The association, although formed under the auspices of the Automobile Club of Great Britain, is an entirely distinct undertaking, the constitution comprising three trustees, a chairman and vice-chairman, a committee of ten solicitors, auditors, treasurer and secretary. T. W. Staplee Firth, of Chancery Lane, W. C., who has already successfully carried through the courts several cases in regard to the rights of automobilists on the road, has consented to act as solicitor for the new association, while G. R. Helmore, of 84 Chancery Lane, W. C., is the secretary. Upon any member having any action or proceedings at law commenced against him, or desiring to commence an action for any matter appertaining to his automobile, he may communicate with the secretary, who will call a meeting of the committee to consider the merits of the case and decide as to the steps to be taken.

A 16-SEATED MOTOR CHAR-A-BANC.

The Motor Manufacturing Co., Ltd., of Coventry, whose heavy vehicles have hitherto been constructed on the Daimler-Panhard system, have just completed a 16-seated char-a-banc on an entirely new design. The gasoline motor is a horizontal two-cylinder one of 11 b.h.p. It is suspended from the rear of a steel channel frame and drives a countershaft by spur gearing. The ignition is electrical, or by an incandescent tube, as desired, while the cylinder is water jacketed, the circulation being maintained by a specal thermo-syphon arrangement. No pump being employed. The variable speed gear consists of a number of pans of gun metal spur wheels—four forward speeds and a reverse motion being provided. Special attention has been devoted to the lubrication of the working parts, while the engine and transmission gear, while being readily accessible, are entirely inclosed, and so protected from dust and dirt. The countershaft is geared to the rear axle by duplicate chains and sprockets. The frame is suspended by horn blocks and plates, and helical springs on the axles, while the body, which is entirely distinct, is suspended on the frame by helical and C-spring. This suspension arrangement is one of the features of the carriage, the amount of vibration experienced by the passenger being reduced thereby, it is claimed, to a minimum. Steering is controlled by a hand wheel, and another feature is that all the control levers—variable speed gear, lubricator governor, accelerator, pressure pump for burners and reverse motion—are mounted on the steering standard within convenient reach of the driver. The four rows of seats are, it will be noticed, arranged in tiers, enabling the rear passengers to see over the heads of those in front. The gasoline and water tanks have a capacity sufficient for a run of 120 miles. The

CHAR-A-BANC OF THE MOTOR MFG. CO.

wagon illustrated being geared to a maximum speed of 12 miles per hour. The wheels are of strong construction, and are shod with 3-in. solid rubber tires. The carriage complete weighs 3,200 lbs.

THE CARRIAGE OF GASOLINE ON RAILWAYS.

The railway companies are now beginning to place difficulties in the way of automobilists in this country by imposing difficulties in regard to the transport of gasoline. I append an extract from a circular just issued by the Anglo-American Oil Co., Ltd.:

The railway companies, after having carried petroleum spirit (i. e., benzine, benzoline, naphtha, gasoline, etc.) for upward of a quarter of a century with security and profit to themselves, are now attempting to impose conditions for its transportation to which we will not, under any circumstances, become a contracting party. The railway companies are seeking, without any justification whatever, to compel the sender to indemnify the railway company against all claims for injury to person or property arising directly or indirectly from the inflammable qualities of the said goods from non-compliance with their regulations and conditions as to packing such goods, and to pay full compensation for all injury to the railway company's servants and damage to their property so arising, unless it can be proved that the injury or damage is due to the willful neglect of the company's servants. There are other terms imposed which seem to us nearly as objectionable.

The far-reaching consequences which are possible under the wording of the consignment note will be apparent to you, and our reasons for refusing to assume such liability require explanation. We are perfectly willing to comply with the railway company's regulations as to packing spirit, so far as these may be practicable; but we refuse to become responsible for loss or damage or injury of any kind after the goods have passed out of our control into that of the railway company.

Though we cannot honestly recommend you to assume a liability which we are unwilling to accept, we herewith notify you that we must decline, in the future, to execute your orders for petroleum spirit (if the goods are to be forwarded by railway) unless the same be accompanied in each instance by your written authority to us, to the effect of the inclosed form, to sign the railway companies' consignment note on your behalf as the consignor or sender of the goods.

HIGH-POWERED CARRIAGES.

A good deal of interest is just now being centered in English automobile circles as to the probable horse power of the racing carriages which are being secretly constructed for the forthcoming racing season. It has been stated that carriages of 50 h.p., and even 100 h.p., were being built in Paris, but the Hon. C. S. Rolls promptly wrote to one of the papers here stating that these were merely on paper, and that the majority of the French racing chauffeurs would this year be content with 16 h.p. motors. I have definite information from Paris, however, that the Peugeot Co. are constructing a 50 h.p. racer, that the Mors Co. are building a 24 h.p. carriage, and that for the forthcoming Nice race Audibert & Lavirotte, of Lyons, are constructing three vehicles which will each have engines of 36 h.p.

AUTOMOBILES IN AFRICA.

Automobilists will be interested in the news that has come to hand this week of a journey which M. Chaudié, Governor of French Western Africa, has just made in his motor car.

He started from Kati, on the Niger, a little village a few miles from Bamako, on Jan. 22, and arrived at Toukouto on the 27th, whence he was able to take the train to Kayes, where his business led him. The part of the journey from Kati to Toukouto was entirely performed in a motor car. Thus, in five days M. Chaudie completed a journey which had previously taken him 15.

M. Chaudié is now busy organizing a complete service of motor transport, which is expected to prove invaluable in opening up commerce in French Western Africa. The vehicle employed was an Amedée Bollée, built by De Dietrich & Co., of Linéville, France.

PROGRESS WITH ELECTRIC VEHICLES.

A fair amount of progress has been made in electric vehicles in the United Kingdom during the past year, although the accumulators still continue the bête noir. The Headlands Co. and Messrs. McKenzie have brought out some neat types of carriages. C. Oppermann, too, has introduced a new frame and method of gearing, and has something new on the stocks in the way of accumulators. Several new carriages, in which electricity supplies the motive power, have also been brought to the notice of the automobile world, among which are the fall, the clift, the carriages of the Electric Motive Power Co., Ltd., and those of the Electrical Undertakings, Ltd.

THE AUTOMOBILE CLUB 1,000-MILE TRIAL.

Feb. 1 was the last date for the receipt of entries, without payment of supplemental fee, for the forthcoming 1,000-mile trial of the Automobile Club, and, as showing the interest which is being taken therein, it may be mentioned that on that date no less than 60 entries had been received—20 in the amateurs or private owners' section, and 40 in the manufacturers' and agents' category.

Two new automobile companies have been formed here during the past week. The first Accles-Turrell Autocars, Ltd., with a capital of £30,000, for the acquisition of the business of motor and motor car manufacturers, as now carried on at Holford Works, Perry Bar, near Birmingham, as Accles-Turrell, and to develop and extend the same. The other is the Yorkshire Motor Car Mfg. Co., Ltd., which has just been registered, with a capital of £50,000, to acquire and take over as a going concern the business now carried on at Bradford, under the style of the Yorkshire Motor Car Co., Ltd., and the business now carried on at Halifax and Hipperholm, Yorkshire, under the style of Brown & Buckton.

A series of automobile trials have this week been held in the Birmingham district in connection with the Midland Cycle and Motor Exhibition. The latter itself was not very interesting, except for the motor exhibits, which comprised no novelties.

The formation of new automobile clubs proceeds apace. The latest is the Manchester Motor Club, which starts off with about 30 members. Manchester has now two clubs exclusively devoted to automobilism.

I hear that the Duke of Manchester has ordered a Locomobile. Deliveries of these carriages are now regularly reaching this country from the United States.

Compound Steam Engines.

By R. I. Clegg.

According to Mr. F. H. Colvin, who endeavored, before a meeting of the junior section of the American Society of Mechanical Engineers, to place where it belongs the credit for early ideas and designs in this field, the first compounding of a locomotive was the design of Thomas Craddock, of England, who, in his book on the chemistry of the steam engine, published in 1848, described a "twin-cylinder engine, having one valve serving for ingress and egress of steam into both cylinders." Craddock abandoned the single crosshead idea, but his first actual engine connected both cylinders to one crank pin. Both the cylinders are operated by one slide valve. It is also interesting to note that he used a fan condenser, with which he claimed to have secured 18 in. of vacuum. The cylinders were 6 and 14 in., and 115 lbs. pressure was determined on, though he predicted 200 lbs. in a few years. The first compound engines of which we have an actual record of performance were, according to F. W. Crohn, in Proc. Inst. M. E., London, 1879, the invention of Mr. John Nicholson, 1850. The first is said to have shown an economy of 20 per cent. in fuel (coke at that time). The ratio was 1 to 1.36. In the same year James Samuels patented a two-cylinder compound, a portion of the high pressure exhaust going out of exhaust nozzle for blasting fire. Annular cylinders, with a ratio of 1 to 4½, were patented in England by Frase Shelby in 1862. In 1867 a yard engine of the Erie road in Buffalo, N. Y., was changed to compound, according to the design of Perry Lay. This was a tandem four-cylinder engine, with cylinders 12 and 24 x 24 in. stroke. This was probably the first compound locomotive in America.

In 1870 the Remingtons, at Ilion, N. Y., made a two-cylinder compound, with an intercepting valve under control of the engineer. Anatole Mallet appears to have been the first to describe the use of a reducing valve to equalize work done when acting simple. Worsdell & Von Barries built two-cylinder compounds in 1887, with intercepting valves which put the engine in compound as soon as the exhaust from high pressure reached a predetermined pressure in the receiver. The Webb system has either three or four cylinders—generally three, with the two high pressure ones outside, connecting with the rear drivers, and the low pressure cylinder or cylinders between the frames connected by a cranked axle to the forward drivers. The two pairs of drivers are not connected, and there are times when it is rather startling to see one pair slip and the other remain stationary, owing to low pressure crank being on the center. The only engine of this type in this country was the No. 1320 of the Pennsylvania Railroad, brought here in 1899. It did good service despite its faults and the prejudice it had to contend with and saved about 20 per cent. in fuel. In the address referred to the Rhode Island Locomotive Works was credited with being one of the first American shops to bring out a compound locomotive.

In one of the railroad journals some simple rules are given for estimating the comparative power of simple and compound locomotives. Taking 180 lbs. pressure of steam in each, an 18-in. engine is found to be rated as equal to a Vauclain compound having 13-in. high pressure and 22-in. low pressure cylinders. Adding 13 and 22 together gives 35, which comes within one of being twice the diameters of the simple engine. Double the diameter of the simple engine's cylinder, then, equals the added or combined diameters of high and low, and three-fourths of the simple cylinder equals high pressure of compound. This seems to be borne out fairly well all through the table, and near enough for a rough estimate offhand.

In the case of two-cylinder compounds, a rough calculation can be made by assuming the high pressure cylinder to be 10 per cent. larger than the cylinder of a simple engine, and make the low pressure cylinder one and one-half times this. This gives a ratio of 2¼ to 1, which is an average for two-cylinder compounds. This, for a two-cylinder compound equal to a 20-in. simple, would give a high pressure cylinder of 22 in. and a low of 33 in., which would not be very far off. In comparing a compound to a simple, divide the high pressure cylinder by 11 and multiply by 10, which gives the diameter of simple cylinder of approximately equal power. The question of compounding is of importance to all students of the problems involved in the application of the steam motor to vehicles; and to those of us who are familiar with the light steam vehicles that have come so rapidly to the front in this country during the past two years, it is very interesting to compare the toylike engine applied in the one case to the rugged outfit attached to heavy wagons in the Liverpool trials.

The circumstances are entirely changed, each of the competing vehicles being supplied with a compound, or triple, expansion engine.

The Thornycroft steam lorry, with a load capacity of 3½ tons, had a horizontal compound engine, wholly inclosed in an oil-tight casing, cylinders, 4 in. and 7 in. diameter, with 5-in. stroke, and is stated to give 20-b.h.p. at 440 revolutions per minute.

No condenser was used, but the exhaust steam passed through a simple form of feed water heater before reaching the blast nozzle at the base of the smokestack.

The Coulthard lorry, capacity, 2 tons, had a triple-expansion vertical engine, with cylinders 2¾ in., 4⅜ in. and 6 in. diameter and 5-in. stroke, and is stated to develop 14-b.h.p. at 500 revolutions per minute. An atmospheric condenser, consisting of vertical rows of indented tubes, is fitted at the front of the vehicle.

The Leyland steam lorry, with a load capacity of 4 tons, had a compound engine of 2¾ in. and 5 in. cylinders, with a 6-in. stroke, and was rated at 14-b.h.p. at 400 revolutions per minute. A peculiarity of this engine was the hollow shafts, through which the lubricating oil was forced.

The steam lorry built by the Clarkson & Capel Steam Car Syndicate had a carrying capacity of 4 tons. The vertical engine is compound, with cylinders 2¾ in. and 6 in. diameter and 4-in. stroke, inclosed in an oil-tight casing, and is claimed to develop 14-b.h.p. at 600 revolutions per minute. An atmospheric condenser is fitted on the roof of the cab, a propelling fan being used to circulate the air for cooling purposes. The condenser pipe is wound with a coil of wire on the exterior. This last is noteworthy, because of the statements in our English contemporaries that the Locomobile Co. have acquired an interest in this condenser, as well as the burner described in our Steam Boiler Number of Dec. 6, 1899.

The 3½-ton lorry built by the Bayley Co., Ltd., employed a Straker compound vertical engine, with cylinders 4 in. and 7 in. diameter and 5-in. stroke, rated at 22-b.h.p. when running at 500 revolutions per minute. It was completely inclosed in an oil-tight casing.

Aside altogether from the question of economy, no small item in a heavy truck, the possibility of reducing the terminal steam pressure, with the advantage of using at the start the powerful torque obtained by the employment of high pressure steam in the large cylinder, suggest the propriety of greater attention being directed to the compound engine for steam vehicle work. Little attention seems to have been paid to it, for some unexplained reason. Perhaps the difficulty encountered in starting a compound engine, where the cranks may not be in such a position that the high pressure piston is acting on the dead center, may have had something to do with the case. It is, however, such an easy matter to arrange suitable by-pass valves that a single lever would readily make the change from simple to compound, that this scarcely seems possible. Whatever may be the reason, the field for transportation of heavy loads and the compound steam engine seem so well fitted to each other at the present day that the few items herein presented will at least suggest further study along these lines.

Motor Vehicle Fuels.

The rapid development of the internal combustion engines as a motor for self-propelled vehicles makes it pertinent for us to inquire not only as to the value of the various fuels now in common use, but also as to the possibilities of other fuels with which we are not so familiar.

Fuels for motor vehicle use must fill the following requirements:

First—Enough for a run of 50 miles must be capable of being conveniently stored on the vehicle.

Second—They must not add an excessive amount to the weight on the tires.

Third—They must not add to the hazard of life.

In addition to the above the value of a fuel will be inversely as the amount of labor required in preparing for and storing it in the vehicle, and directly as the convenience of obtaining a supply.

It is a good plan to place a grill work of partitions in all vessels for storing liquid fuels on vehicles, in order to prevent surging or waving of the surface.

The most commonly used fuel for motor vehicles is gasoline or naphtha. This is a light distillate of petroleum with a specific gravity of from 64 to 70, very inflammable and flashing readily at any ordinary temperature.

The usual manner of using this fuel is to pass the supply of air for the engine over the surface of the fuel (it is sometimes sprayed into the current of air) in such a manner that the air absorbs enough of the fuel to make the mixture explosive.

Practice has demonstrated that this fuel works best with a compression not to exceed three (3) atmospheres.

Not the least of the advantages of this fuel is the low temperature of ignition.

In case of a collision, a puncture of the containing vessel is extremely dangerous, if possible chance for ignition is at hand.

Its sale and use is quite common, making it possible to obtain a supply in almost every village.

Another fuel, and one that has the advantage of being on sale almost universally, is kerosene, sometimes called carbon oil. This is a heavier distillate of petroleum, having a flashing test of from 110 to 150 deg. (The flashing test is the highest temperature at which the oil will quench a flame presented to its surface.)

One way to use this fuel is to raise its temperature until it vaporizes, and then use this vapor mixed with air to cause explosive force in the cylinder.

Another mode of using this fuel is to inject a small quantity of the oil into a vessel lined with some refractory material and having the inner surface of this lining raised to incandescence, the vessel being supplied with a fresh charge of air at each injection of the fuel. The oil becomes ignited on coming in contact with the incandescent surface, produces the necessary explosive force.

Crude petroleum can also be used in the manner last described. This arrangement has a very decided advantage for motor vehicle use, in that after once being started it becomes self-igniting.

Acetylene gas is a fuel of much promise, being very rich in heat units, and while yet in the form of carbide is the most convenient to store and handle, and the least dangerous of any of the fuels in common use for motor vehicles. The necessity for the addition of water to the carbide is a negative advantage, which, however, does not amount to a serious drawback.

With the common four-cycle motor the high heat efficiency of this fuel is not properly utilized.

By far too much of the efficiency of all our fuels is lost in the exhaust. Indeed, we might say that so long and in proportion as we continue to purposely dissipate our heat energy in any other manner than by performing work we are crude and uneconomical in our designs.

While we are striving for more perfect and economical design, we shall probably have to content ourselves with the use of acetylene to enrich other gases of lower heat efficiency.

That the various commercial gases are well adapted to motor vehicle use the writer feels quite confident.

There is no difficulty in motor vehicle propulsion in obtaining a horse-power hour for every 15 cu. ft. at atmospheric pressure. On this basis a 4-h.p. motor propelling a vehicle at 20 miles per hour, in order to have a radius of 50 miles, would need a storage capacity of 150 cu. ft. at atmospheric pressure. If the same quantity of gas was compressed to 10 atmospheres it would require but 16 2-3 cu. ft. storage capacity. The question of compression need not be prohibitive or even difficult. A small compressor can easily be arranged to be driven by the vehicle motor, and in less time than a horse would eat a meal it would compress enough gas for a 50-mile run. There are on the market quite a number of pressure regulating valves which, if not entirely satisfactory alone, could be supplemented by a silk diaphragm regulator and by this means a very uniform supply of gas could be obtained for the engine, in spite of the decreasing pressure in storage tanks.

One advantage of this fuel is that the weight of the containing vessel is about all the load imposed on the vehicle.

In the natural gas belt, where the rate is from 20 to 25 cents per 1,000, this would certainly be the cheapest fuel obtainable.

To turn from the fuels already in use to those that are possible, we call to mind the fact that fine particles of any combustible material floating in a current of air become highly explosive when the particles are close enough together so that the combustion of one particle will ignite the adjoining particles. It is for this reason that flour, planing and other mills in which dust of inflammable material accumulates are often wrecked by severe explosions.

P. L. TYGARD.

COMMUNICATIONS.

Motor Vehicle Wheels.

Laconia, N. H., Feb. 12.

Editor Horseless Age:

In looking over the recent motor vehicle exhibit at Madison Square, New York city, one could not help noticing the random collection of wheels used on the different makes of vehicles. The wheels of scarcely any two vehicles were of the same size and construction, some being modeled after the bicycle pattern and constructed of wire throughout, while other were constructed of wood and were made in odd designs, some having few spokes, others many. It would seem, even to the casual observer, as though there should be more uniformity and some better construction for motor carriage wheels, and our American inventors and manufacturers ought to be able to construct a wheel that would be better adapted for motor vehicles than any seen at the present time. It seems as though manufacturers, in their eagerness to get a vehicle built, have paid little or no attention to the requirements of a motor carriage wheel. The subject is one that certainly deserves more attention than it has received up to the present time.

The wheels of self-propelled vehicles are necessarily obliged to sustain and carry a considerable load, not only performing the office of sustaining the weight of the vehicle itself, and the occupants, but also of the motor and power generating machinery. It is hence essential that the wheels should be strong and capable of upholding the necessary weight. In order to be sufficiently strong, it is essential that such wheels should have radial spokes, such as are ordinarily employed in horse-drawn vehicle wheels, since such spokes are ample to sustain the weight, and, at the same time, render the wheels themselves light. Experience demonstrates, however, that while wheels with such radial spokes are sufficiently strong to sustain the necessary weight, they are ineffective to withstand the torsional strain due to the application of the driving force when such wheels are used as traction wheels. In whatever way the power is applied on a self-propelled vehicle to the tractional wheels, there is always involved a strain which is at right angles to the length of the spokes, and while such radial spokes are effective to withstand longitudinal strain, such as they are subjected to by the weight of the vehicle, they are ineffective to withstand a lateral strain, such as is placed upon them by the driving force. The result is, that if an ordinary wheel with radial spokes is used as the traction wheel of a self-propelled vehicle, the driving strain tends to roll the spokes from their sockets and renders the wheel useless in a short time; and if the driving gear is clasped to the middle of the spokes, the driving strain tends to shear the spokes, with the same result.

Wire wheels of the bicycle pattern are all right for what they were intended for, but when used for carrying heavy loads over rough and uneven roads, it is wanting in more than one particular, and is no better adapted for this purpose than a wood wheel having radial spokes is to withstand the torsional strain due to the application of the driving force. When the fine threads become rusty, as they are bound to do in course of time, the spokes will give way and the wheel will break down when least expected.

An examination of the motor vehicle wheels on the market to-day reveals a general weakness of construction, suggesting that the manufacturer has greatly underestimated the strains that try the traction wheel. It yet remains for the inventor to construct a perfect traction wheel that will sustain the load and at the same time withstand the torsional strain due to the application of the driving force. F. A. P.

One Who Knows the Anglo-Americans.

New York, Feb. 15.

Editor Horseless Age:

I have read your editorial re. the Anglo-American Rapid Vehicle Co., with considerable interest, and think it the duty of all interested in the building up of legitimate business to compliment you on the firm stand you have taken at the beginning of this promotion business. We take all the English motor vehicle journals and are thus in a position to know the enormous amount of injury that the principals whose names you mention have done the business over there. For this reason we appreciate your stand.

Wishing you every success,

CLARENCE C. BRAMWELL.

Holdfast Tires.

New York, Feb. 5.

Editor Horseless Age:

I had one of the tires alluded to in my recent letter to you bolted on the rear wheels of a stage, having inserted Holdfast horseshoe calks in it, and it prevented the hind part of the stage slewing on the ice, even on steep hills, so that it should be an admirable arrangement for automobiles in slippery times. A. F. Sherwood, of Peekskill, N. Y., has the stage in his stable. Yours truly,

C. DE P. FIELD.

Down With Lawsonism.

New York, Feb. 10.

Editor Horseless Age:

I offer you my heartiest congratulations upon your masterly and fearless arraignment of the Lawson-Pennington combination. The sport and the trade are both deeply in your debt for this and other defenses of their best interests which you have made.

A SUBSCRIBER.

Motor-Starting Device.

Buffalo, N. Y., February 15.

Editor Horseless Age:

In a recent number of your paper the writer's attention was called to a simple starting device, consisting of a slack chain and spring with a sprocket wheel rigidly attached to a motor shaft. According to the illustration and description the writer gathered the impression that when you pulled on the chain the chain became engaged with the sprocket wheel, giving the necessary rotation to the engine to cause the first explosion. Either the writer does not understand this thoroughly, or it is his opinion the device has never been used.

as it would seem to him that when the first explosion does take place, with the chain engaged, that would be the end of the spring or stop. This device should have some means of relieving itself or the wheel should be mounted on a shaft, not with a set-screw, but with some ratchet device to turn in one direction only. The writer's idea for such a device would be to have a ratchet wheel rigidly attached to shaft, with an arm and pawl to be operated by arm or foot power, and when the arm was way back the pawl would strike a stop, keeping it disengaged from the ratchet wheel so that in stopping the motor it could oscillate back and forth, and would not strike the pawl. This device would let go when the first explosion took place, and when the arm was back, there would be no danger of a back kick on the motor engaging the pawl.

The writer is starting a Niagara Motor, which has means of reducing the compression in starting, by a simple strap with a spring on one end passing round the pulley. By a sudden pull on the strap the tension of the spring on the other end gives adhesion sufficient to rotate the engine.

Another matter attracting the attention of the writer was the description of the DeDion sparker in your Explosion Motor Number. The writer has always understood that the value of the DeDion sparker lay in the fact that when the contact block was properly adjusted it would not make contact and short-circuit the batteries when turned round and left with the cavity in the cam under the block, that it required the sudden drop of the block to give it inertia sufficient to go down and make a contact which served not only as a vibrator but has the advantage of economy in the use of the battery. Yours truly, W. S. HOWARD.

MINOR MENTION.

Terry Stafford, a Topeka (Kan.) mechanic, has about finished a gasoline carriage.

Frank M. Underwood, Sandusky, O., has constructed a gasoline machine.

The Sandusky Automobile Mfg. Co. has been organized under Ohio laws with $5,000 capital stock.

Joseph Jackson was arrested in New York city recently for running a Locomobile without a license.

The Automobile Forecarriage Co. has been incorporated under West Virginia laws, with a capital stock of $5,000,000.

The John Wilkinson Automobile Co., Syracuse, N. Y., has secured an option on the Cobb factory building, in East Water St.

A new West Virginia corporation is the American Vehicle Co., capital stock $1,000,000, organized by J. Acken, E. F. Slocum, R. H. Hungerford, A. H. Cooke and J. D. Campbell, to utilize compressed air as motive power for vehicles.

The Consolidated Motor Vehicle Co. has been organized at Newark, N. J., with $100,000 capital, $1,000 of which is paid in. John W. Moalster, James S. Garvin and Frederick Smith are the incorporators.

The Baldwin Cycle Chain Co., Worcester, Mass., have just issued a special booklet on their automobile chains, of which they now make about a dozen different sizes. Baldwin chains are much favored by motor vehicle builders.

The Non-Polarizing Dry Battery Co., manufacturers of the "O. K." batteries, have elected a new board of officers. Edward Martin, Jr., is president; James Cruickshank, vice-president, and C. N. Brizse, secretary and treasurer.

The Locke Regulator Co., Salem, Mass., are making a full line of fittings for steam carriages, including pin valves, injectors, gasoline regulators, water regulators, glass gauges, globe and check valves, water relief valves, steam gauges and safety valves.

Charles H. Black, Indianapolis, Ind., who has been experimenting in gasoline motor vehicles for several years, is said to have interested eastern capital and to be about to erect a factory 150 x 300 ft. and three stories high. The new concern will manufacture vans and trucks as well as carriages.

The Automotor, the well-known English technical journal, has issued the 1900 edition of its "Pocket Book of Automotive Formulæ and Commercial Intelligence," containing much new and useful matter. It is published at 1s. (limp cloth cover, 1s. 6d.) by F. King & Co., 62 St. Martin's Lane, London, W. C.

L. S. Dow, formerly secretary and general manager of the Indiana Bicycle Co., Indianapolis, Ind., has taken the presidency of a new automobile manufacturing concern, just organized in that city, and said to have a backing of $1,000,000. A. C. Newby, of the Indianapolis Chain & Stamping Co., is also interested. Electric and other vehicles will be made.

The Automobile Forecarriage Co. has been incorporated under West Virginia laws, with a capital stock of $5,000,000 by H. Bergholtz, of Ithaca, N. Y.; J. W. S. Langeman, of Paris, France; E. J. Patterson, of Plainfield, N. J., and Wm. Hazleton and F. H. Rosse, of New York city. The company will manufacture the Kullstein-Vollmer gasoline forecarriage and other automobiles.

The Crouch Automobile Mfg. & Transportation Co., of Baltimore, is in difficulties. It has been made defendant in an application for a receiver filed by Wallace Stebbins & Sons, who charge that the business has been unprofitable and that the company is heavily indebted and cannot pay its debts. The judge ordered the appointment of a receiver on Feb. 26, unless the defendant can show cause to the contrary. The concern had no adequate backing, and was mismanaged.

OUR FOREIGN EXCHANGES.

Improvements in Internal Combustion Motors.

Messrs. Crossley & Atkinson, of Manchester, have lately effected several very important improvements in the design and construction of internal combustion motors. They have adopted the "compound," or two stage, expansion principle. In the motor referred to, which we illustrate (see Figs. 1 and 2), there are three cylinders, A, B and C, two, B and C, being high pressure ones, in which the charge is drawn in, compressed, ignited and expanded in the ordinary Otto cycle, and the other, A, being the low pressure cylinder, which is preferably placed between the two high pressure cylinders, and has its piston, D, connected in the ordinary manner to a crank pin, E, on the crank shaft F, common to all the cylinders. The high pressure cylinders B and C have their pistons connected to crank pins G and H in such a manner that they complete their inward and outward strokes together, but at an interval of 180 deg. from the crank pin E of the low pressure piston D —that is to say, when the high pressure pistons are in their furthest "in" position, the low pressure piston D is in its furthest "out" position, as seen in Fig. 1. The low pressure cylinder is made about twice the area of the high pressure cylinders, and the mouths of all the cylinders open to an inclosed crank chamber, I. Owing to the position of the cranks and the areas of the pistons, the pressure on this inclosed crank chamber remains constant while the motor is running.

The low pressure piston and connecting rod are made about the weight of the two high pressure pistons and their connecting rods, so that by balancing the rotating parts the engine is suitable for running at a high rate of speed without causing any material vibration or requiring heavy foundations.

The valves for the admission of gas and air and for the exhaust of the high pressure cylinders are similar to those used by Messrs. Crossley in their ordinary engines, but are so arranged that working strokes are made alternately, thus providing for an impulse each revolution. After a working stroke in either high pressure cylinder, the exhaust takes place into the low pressure cylinder, and as these exhausts take place alternately from either high pressure cylinder, power is given out by the low pressure piston once every revolution, and between the working strokes in the high pressure cylinders. Power is thus given out twice per revolution when ignitions are allowed to take place continuously in the high pressure cylinders.

Interposed between the high pressure exhaust valves and the low pressure cylinder is a valve, J. This may be a piston valve, driven by means of an eccentric or crank pin, L, on one of the cam shafts M, which revolves once for each two revolutions of the engine crank shaft. There are two ports, N^1 and N^2, in the low pressure cylinder, and a port, O, leading to the atmosphere, and three pistons or disks, P, Q and R, forming the piston valve; the following sequence of operations takes place: Passage clear for the exhaust from, say, the left high pressure cylinder to the low pressure cylinder, owing to the position of the piston valve, but the actual timing of this exhaust deferred and defined by the opening of the left high pressure exhaust valve S. Outward stroke of the low pressure piston D, toward the end of which the exhaust from the low pressure cylinder to the atmosphere is opened by the piston valve J. Free passage opened from the left high pressure cylinder to the atmosphere while its piston is at about its inward dead center, and just before it commences its suction stroke both piston valve J and exhaust valve S, being open, as in Fig. 1, where it will be seen that the disk P of the valve J is not so wide as the port N^1, leaving a free passage from the cylinders B and A to the atmosphere. The valve J at this time is moving in the direction shown by the arrow. Passage from the left high pressure cylinder cut off by the disk P of the piston valve J. Inward exhaust stroke of the low pressure piston, the port N^1 being open to the port O, the exhaust continuing throughout the greater part of this stroke by these passages through the piston valve J being open. Opening of the exhaust passage from the right high pressure cylinder by the piston valve, but the actual timing of this exhaust deferred and defined by the opening of the right high pressure exhaust valve. Closing of the exhaust from the low pressure cylinder A by the piston valve J, so as to provide for a compression filling its clearance spaces. Opening of the right high pressure exhaust valve. Outward stroke of the low pressure piston D, toward the end of which the exhaust from the low pressure cylinder A is opened by the piston valve J. Free passage opened from the right high pressure cylinder C to the atmosphere, both the piston valve J and the high pressure exhaust valve being open while its piston is about at its inward dead center, and just before it commences its suction stroke, the disk R of the valve J being opposite the port N^2, but, not being so wide as the port, free passage is left from the cylinder A and the cylinder C. Passage from the right high pressure cylinder C cut off by the piston valve J. Inward exhaust stroke of the low pressure piston D, the exhaust continuing throughout the greater part of this stroke, by the piston valve J being open. Opening of the exhaust passage from the left high pressure cylinder B by the piston valve J, but the actual time of this exhaust deferred and defined by the opening of the left high pressure exhaust valve S. Thus the cycle of movements is completed by one backward and forward movement of the piston valve J, while the engine makes two complete revolutions. In a quick-running engine the slow reciprocation of the piston valve J is a great advantage. Modified arrangements of this valve may be used, but the sequence of operations above described is necessary to give the best results.

A further advantage derived is that the piston valve cuts off the exhaust from both high pressure cylinders alternately; thus, while they are making their suction strokes, their respective exhaust valves may be allowed to close slowly and quietly a considerable period of time after their actual exhausts have been completed.—Automotor Journal.

The Marmonier Motor.

M. Marmonier, an engineer of Lyons, has designed an explosive motor, which presents some advantages. The elasticity of the motor is such that one is able to vary the power of the motor and thereby regulate the speed of the vehicle, and to obtain these results without sacrificing complete combustion.

The Marmonier motor is arranged thus, vide Fig. 1: The two cylinders A A are parallel and open at both ends. They

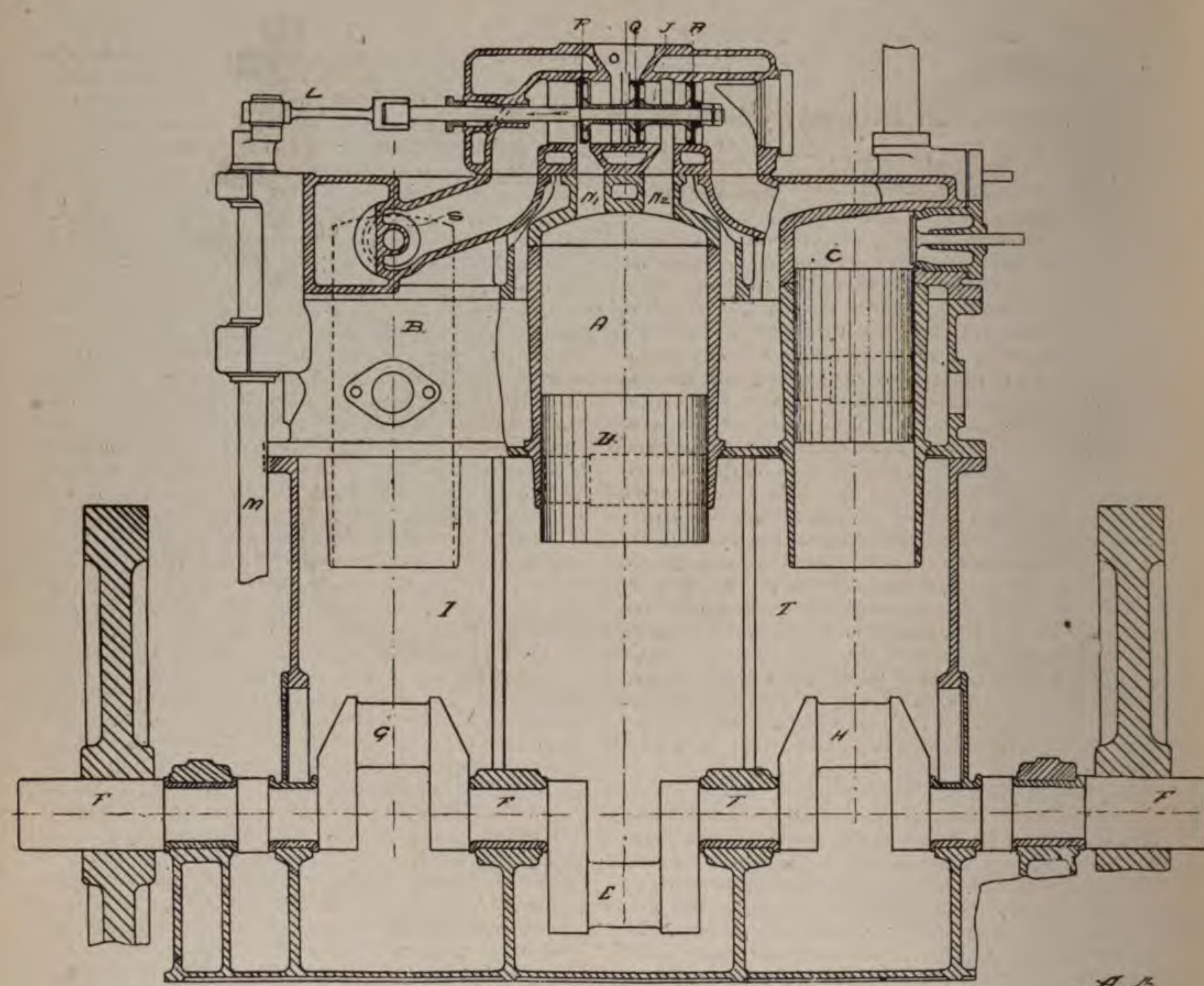


FIG. 1.—Sectional Elevation of Motor.

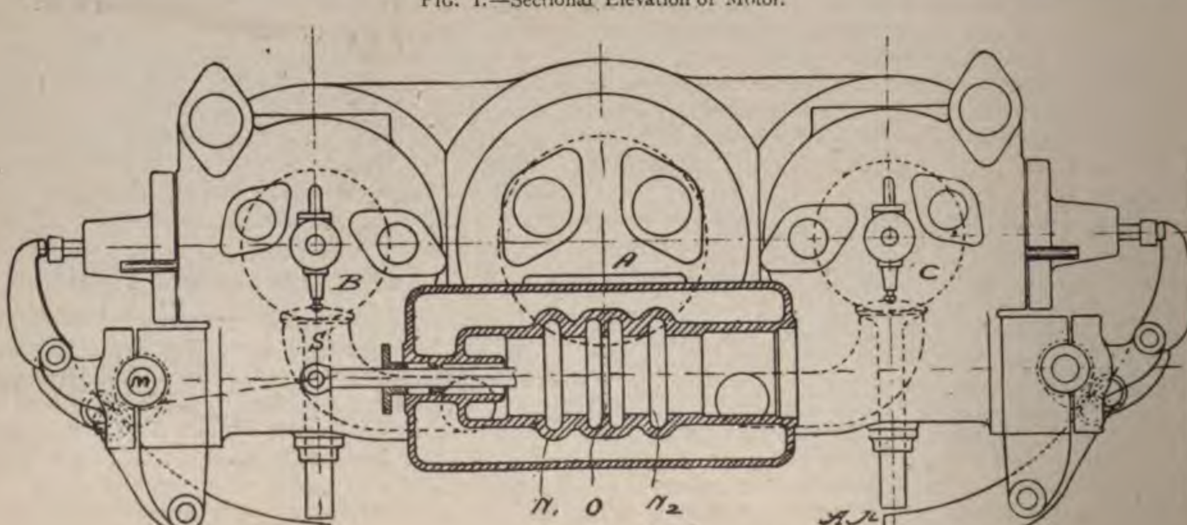
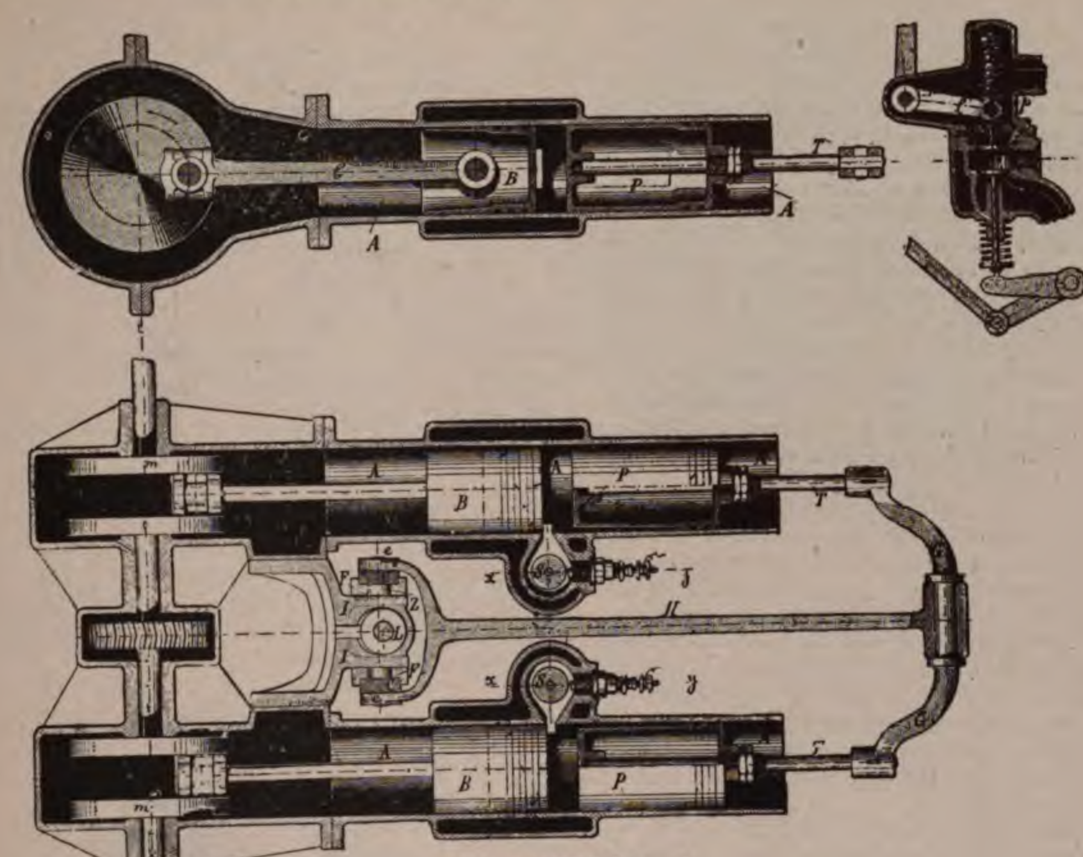


FIG. 2.—Plan of Cylinder Heads.

CROSSLEY & ATKINSON'S INTERNAL COMBUSTION MOTOR.



MARMONIER MOTOR, FIG. 1

are inclosed by pistons B B, attached to the motor shaft by the connecting rods b b and cranks m m, and the counter-pistons P P which are attached, the one to the other, by rods T T and a rigid connecting arm or stirrup, G. The crank shaft carries a pinion, which meshes with a spur gear of double the diameter to operate the distribution, on the usual four-cycle style.

This half-speed gear D, Fig. 2, has on each of the flat sides a cam, d, which moves back and forth the cam rolls E, which in turn, through the connecting rods K, control the slotted link F and revolve it about the fixed pivot Z.

In L we see the regulating shaft, terminated by a long screw, M; the screw actuates the movable block sliding in the guides of the slotted link from top to bottom, and vice versa. Such is a very brief description of the arrangement. The position of the valves, the ignition plugs, etc., are sufficiently indicated by the engravings.

Let us now examine the motor at work. The piston is at the beginning of the first cycle; admission takes place. The cam d moves the rollers E, causing the link F to have an oscillation from right to left. If the sliding block, controlled by the driver, is so placed that the pitman H is in line with the axis of the cylinders, the counter-pistons P P remain immovable. In this case the total admission will be equal to the volume displaced by the piston.

If, on the contrary, the sliding block occupies a lower position in the link, as shown in Fig. 2, the pitman H will force the counter-pistons into the cylinders as the piston continues the admission stroke; less gas will accordingly be admitted. And furthermore, the admission will be the more reduced as the block is placed lower in the link. This will continue to a

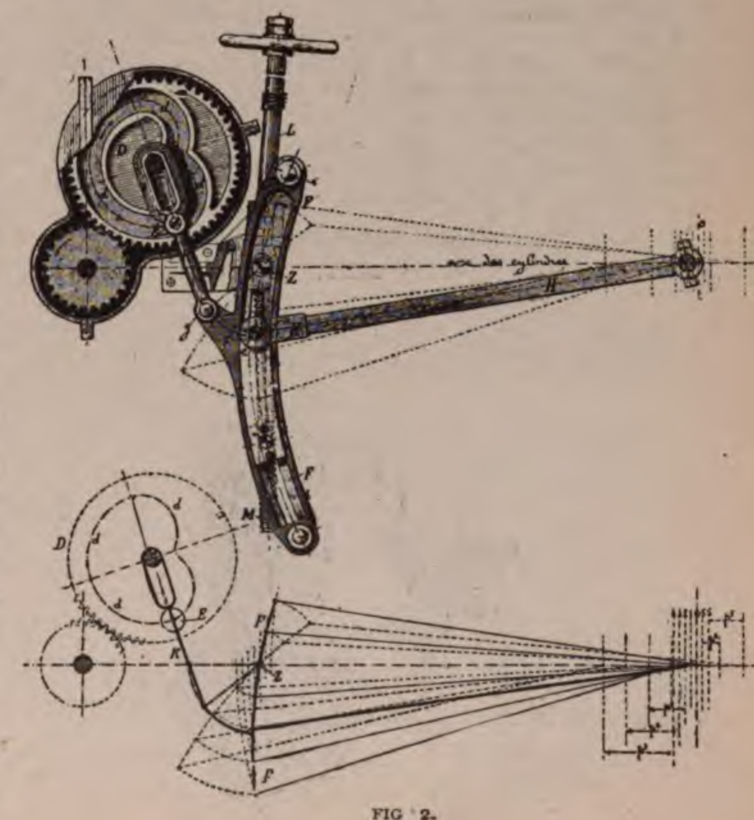


FIG 2.

point where the block is at the lowest point, and the admission will practically be nil.

On the other hand, if the block passes above the axis of the cylinders, the link receives an oscillation in the opposite direction, in moving about the pivot Z; the counter-piston moves away from the piston as the block permits, with the effect that the counter-piston itself draws in a quantity of fresh air to be added to the amount obtained by the piston.

The second cycle is reached—compression. The rolls E continue moving on the cam d. The slotted link oscillates from left to right, and the counter-piston returns to the starting point.

The third and fourth cycles are passed normally, the rollers E moving in the cylindrical portion of the cam d, the link F and, necessarily, the counter-pistons P P, remaining immovable. During this time the pistons complete the working stroke and then, subsequently, the expulsion of the gases.

* * * * * * * * *

If we suppose the counter-pistons advance toward the pistons so far that the space between them will be less than normal, then it will follow that, first, the products of combustion remaining at the end of the expulsion stroke will be less; second, the admission is lessened; third, the compression remains the same, because the lessened volume of gas operates in a space proportionally smaller. The composition of the mixture and the compression remain the same in all cases.

Inversely, when the sliding block passes above the level of the pivot Z, and the counter-pistons move away, the admission is increased, the compression operates in a larger space, and in the exact proportion.

If the sliding block occupies the lowest position, as we have seen, there is no admission, the counter-piston P following the piston closely, and thus rendering the admission stroke useless.

The link, in this device, is analogous to the link motion of a steam engine. It is the principal organ of distribution. Regulating the movements of the counter-pistons and reducing or increasing the quantity of fresh gas admitted, as well as augmenting or lessening simultaneously the compression chamber.—La France Automobile.

The Noel Gasoline Motors.

A new gasoline motor for tricycles has lately been put on the market in France by Fritscher & Houdry, of Provins (Seine et Marne). It is of the single-cylinder, vertical type,

Fig. 1.

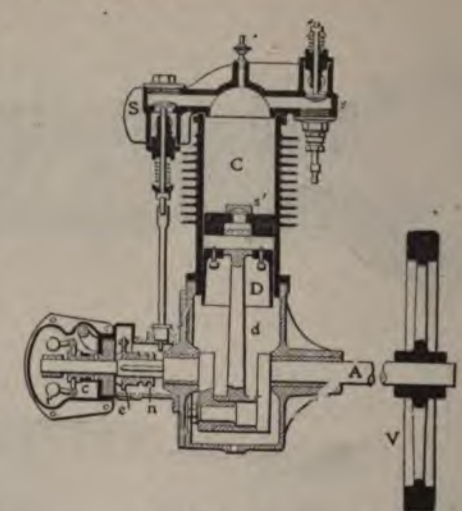


Fig. 3.

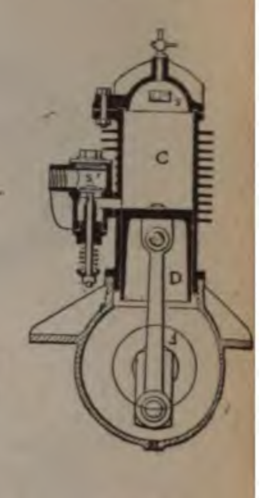


Fig. 4.

with radial disks for cooling purposes, and electrical ignition (Figs. 1, 3 and 4). The inlet and exhaust valves are not located one above the other, as usual, but are on each side of

Fig. 2.

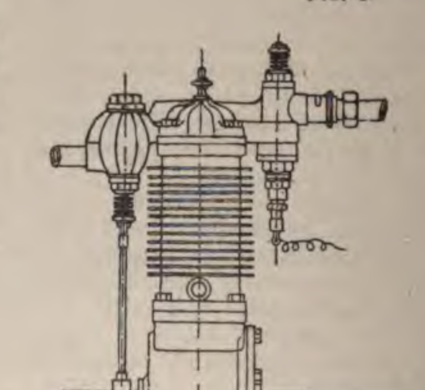


Fig. 5.

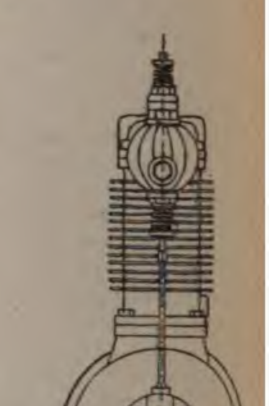


Fig. 6.

the cylinder end. Another feature is the location of the sparking plug below the inlet valve, its position there being claimed to reduce the chance of misfiring, and also the danger of accident to the plug. The exhaust valve, too, is controlled by a special cam on the motor shaft, the use of a second cam shaft being obviated. The fly wheel cranks and connecting rods work in an oil chamber, the sides of which are so made as to be readily detachable, enabling the parts to be quickly examined. Fritscher & Houdry are also making a vertical motor of 3-h.p. for light voiturettes (Figs. 2, 5 and 6). This motor, which weighs 120 lbs., has a fly wheel outside the case. It is of the same type as the small motor as regards the arrangement of the valves, but additional features are the provision of a centrifugal governor and a valve in the piston through which the hottest of the consumed gases are emitted at the commencement of the exhaust stroke, leaving only the cooler gases to be exhausted through the ordinary valve.

Burford & Van Toll, of Twickenham, England, have made arrangements with M. Vivinus, Brussels, Belgium, patentee of the Vivinus motor carriage, to manufacture 600 light carriages of this kind within two years for the English and American markets. The selling price will be about $650. George Richard, the well-known French manufacturer, has taken a license to build 1,000, and De Dietrich of Luneville will put out 750 of them.

Pages from the History of an Anglo-American Promoter.

In reference to Francis D. Carley, one of the promoters of the Anglo-American Rapid Vehicle Co., the New York Commercial of Feb. 15 says:

While Mr. Carley is asking the public to purchase the $75,-000,000 worth of bonds of his new automobile company, he has notes outstanding amounting to $70.533 that the holders would like very much to collect.

These notes are held by J. Kennedy Tod & Co. They were given to that firm by Carley in connection with a deal in a Kentucky railroad. These notes Carley tried later to have set aside on the ground that they were usurious and procured under duress.

Judge Patterson, of the Supreme Court, dismissed the complaint Dec. 26, 1893. Tod & Co. secured judgment on these notes of Carley's, but they are still unpaid, and now in their possession.

Now, as to a little of Francis D. Carley's history. Nearly 40 years ago he left his home in Fort Wayne, Ind., and went to live in Louisville, Ky. There he taught school some, preached a little and financiered a great deal.

Soon after he went to Louisville he established a small oil store in a poor and thinly settled part of the town. His business prospered, and he soon opened a wholesale establishment, taking in with him as partner a young man named Chess.

After 10 years of prosperity, Chess, satisfied with his fortune, retired from business.

Not so Carley. He wanted more than the $1,000,000 that was his at the time of the dissolution of the firm, and he was one of the men who conceived the Standard Oil Co. He entered this monopoly and was put at the head of the Louisville agency, which controlled all the agencies in the South.

When the big English syndicate, backed by enormous capital, established the town of Middlesborough, in the coal and iron country, and began to reach out for more territory, it found that the Kentucky Union Land Co. owned most of it. The Kentucky Union Land Co. was F. D. Carley. To develop the lands he established the Kentucky Union Railroad Co. and built the road with the assistance of J. Kennedy Tod & Co., of New York.

The boom in eastern Kentucky land collapsed and Carley was in financial straits. Suits and counter suits were brought between J. Kennedy Tod & Co. and Carley.

One of the actions brought by Carley against Tod & Co. was a complaint to annul and set aside notes aggregating $70,-533, which he had given to Tod & Co., and also a contract which he had made with the bankers on Sept. 8, 1890. The result of this action is given above.

In the summer of 1895 he organized the Monetary Trust, with himself as president. The Monetary Trust did business through the firm of Carley & Co., of which Charles Stokes was the Stock Exchange member.

About two months after the organization of the trust, Stokes was requested by the law committee of the Stock Exchange to dissolve his partnership with the firm, as it was objectionable to the Exchange. The partnership was dissolved and the Monetary Trust lost its Stock Exchange member.

F. D. Carley continued to do business, however, and his latest coup was during the recent excitement of Jan. 23, when he dealt largely in Pan Handle stock.

Pennington Bobs Up.

Indianapolis, Feb. 11.—There is great interest here and in other towns in Indiana over the announcement to-day from Chicago that E. J. Pennington, the airship inventor, known in Cincinnati, has come to light again. Pennington is the inventor whose airship was to revolutionize the world five years ago.

The Pennington Aerial Mail, Express & Construction Co., capital $3,000,000, filed its incorporation articles in Chicago yesterday, which were granted at Springfield, Ill., Oct. 11, 1892. The directors are E. J. Pennington, Joseph L. McKittrick, James H. Barry, William B. Keep and James E. McElroy.

Pennington ran bandsaw factories at Fort Wayne, Moore's Hill and Edinburg, Ind., in rapid succession, and from there went to Mount Carmel, Ill., from which place his airship was shot forth upon the world.

Pennington then went to London, where he promoted an automobile. He is reported to have grown immensely rich from the sale of his patents to the English. People who backed him in this State lost money.—Cincinnati Commercial Tribune.

MOTOR VEHICLE PATENTS

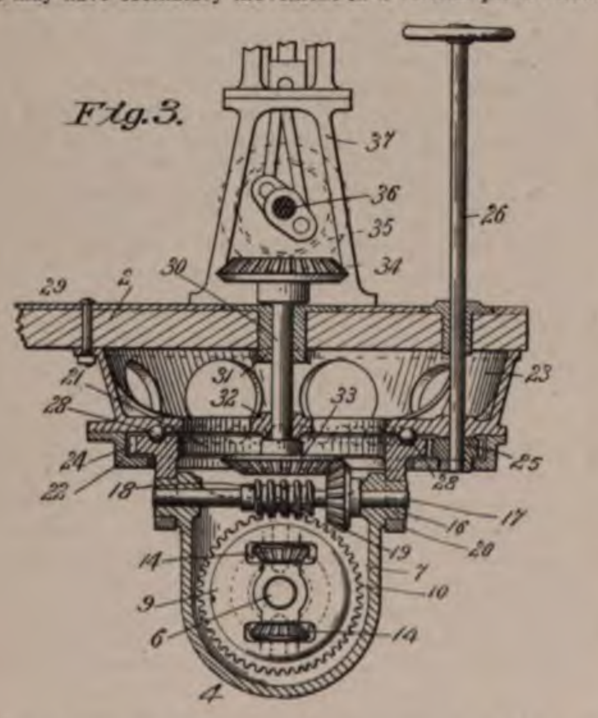
of the world

UNITED STATES PATENTS.

No. 641,834—Jan. 23, 1900—Combined Driving and Steering Axle.—J. H. Bullard, Springfield, Mass.

Fig. 3 is a longitudinal section through the forward portion of the truck. The peculiar arrangement whereby the axle may have oscillatory movement in a vertical plane—note

Fig. 3.



16, 17 and 20—at the same time that the truck may be turned in any direction by the parts 25 and 26, are well illustrated in this illustration.

Nine claims. Application filed April 11, 1899.

No. 642,043—Jan. 23, 1900—Gas Engine.—William A. Kope, Kansas City, Kan.

This relates more particularly to two-cycle motors. The operation of the device is described as follows: The crank shank D is rotated so as to force the piston C downward. The enlarged portion of the piston, descending in the enlarged chamber of the cylinder A, tends to create a vacuum in the said portion of the cylinder above the peripheral enlargement of the piston, and a charge of mixed gas and air then passes through the passage J and past the valve K into the cylinder above the peripheral flange of the piston, the charge being taken from the crank shaft casing chamber, into which it had been previously drawn from the carbureter G through the passage H and past the valve I. After the piston has reached its lowermost position in the cylinder and starts to rise therein, the valve K closes and the valve M opens, permitting the gas charge to pass from the enlarged part of the cylinder through

Fig I

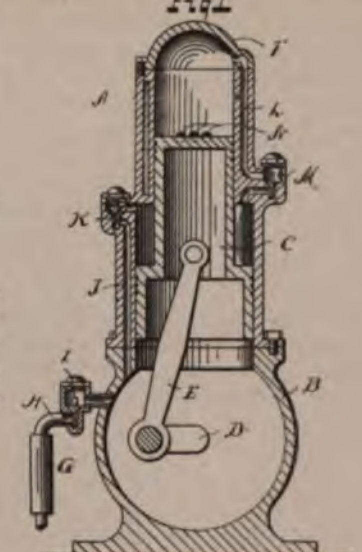
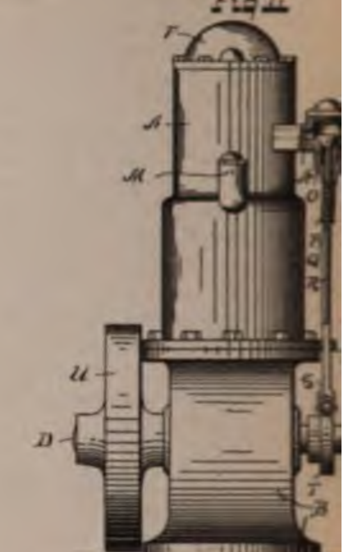


Fig II



the passage L and past the valve M into the chamber above the small part of the piston, where it is compressed by the continued upward movement of the piston. At the time the piston has reached its highest position in the cylinder, the charge of gas has been transferred into the cylinder above the smaller portion of the piston from the enlarged portion of the cylinder, and, owing to the relatively small size of the combustion chamber, compared with the size of the chamber above the peripheral enlargement of the piston, is highly compressed. The charge is then ignited in any of the well-known ways for so doing, as by an ignition tube attached to the combustion chamber, by an electric spark generated in the combustion chamber at the proper time, or by any other desirable firing means. The exploding of the charge forces the piston downward, the effect of the explosion being spent upon the small upper end of the piston. At the time of the exploding of the charge the valve M is closed, thus preventing a back flow of the gas through the passage L. During the upward movement of the piston a fresh charge is drawn into the crank shaft casing chamber through the passage H and past the valve I. This charge is drawn into the enlarged chamber of the cylinder during the following downward movement of the piston through the passage J and past the valve K. During the downward movement of the piston, due to the force of the ignited gas mixture above the upper end of the piston, the exhaust passage N is closed by means of the valve O, which is held to its seat by means of the coil spring P. The cam T is so disposed on the crank shaft D that it will open the valve O at the end of the downward stroke of the piston, thus permitting the burned gas in the upper end of the cylinder to escape through the passage N, which is located in the cylinder at about the middle of the stroke of the small portion of the piston. The fly wheel U, through the momentum imparted to it on the downward stroke of the piston, carries the piston on the upward stroke.

Two claims. Application filed Aug. 6, 1897.

No. 642,167—Jan. 30, 1900—Electric Sparking Plug for Explosive Engines.—F. R. Simms, London, England.

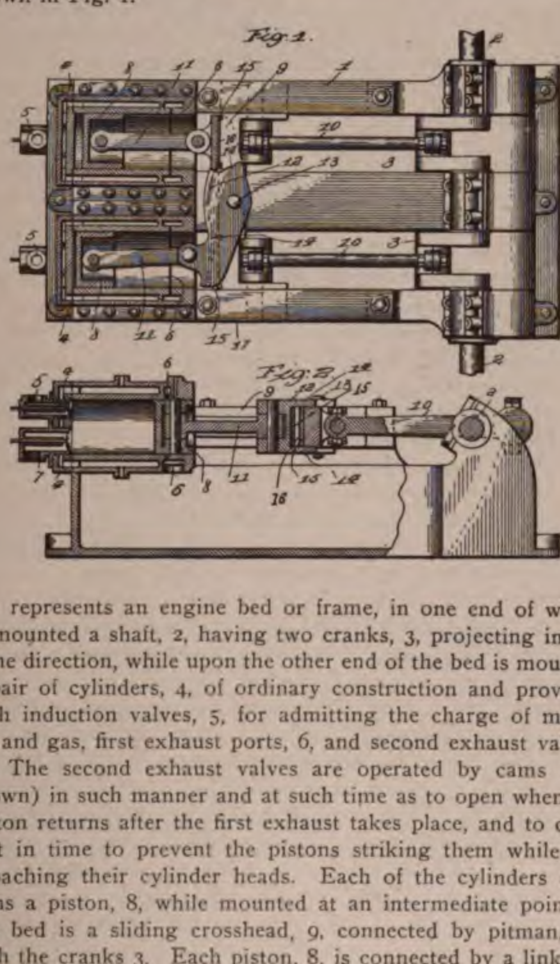
According to the invention to produce better sparking at starting than usual, and to insure the heavy vapor in the combustion chamber being properly ignited when the cylinder is cold, the inventor arranges, in connection with the contact

breaker, a cock, through which is injected a small quantity of a light oil, such as benzine, onto the sparking points. To this end the cock is advantageously screwed upon one of the terminals, which is made hollow, so as to enable the oil to be injected therethrough onto the contact breaker. To provide good insulation, the terminal is insulated from the usual plug by being coated with a hard enamel of a non-conducting substance, and by being inclosed in asbestos packing, which is held in place at the outer end by a conical washer and a lock nut screwed upon the said terminal, the lock nut and washer being shielded from damage by an inclosing cylindrical portion of the plug, the open end of which is closed by a porcelain or other suitable washer, held in position by a metal washer and nut. The inner end of the asbestos packing may also be held in position by a cone upon the terminal and be provided, if required, with a shield.

Ten claims. Application filed July 17, 1899.

No. 642,143—Jan. 30, 1900—Explosive Engine.—Thomas Malcolmson, Siverly, Pa.

Fig. 1 is a plan, the cylinders, pistons and a portion of the rocking beam being shown in section for the purpose of disclosing the construction of the parts. Fig. 2 is a vertical longitudinal section through the center of one of the cylinders, the piston being at the end of its stroke opposite to that shown in Fig. 1.



1 represents an engine bed or frame, in one end of which is mounted a shaft, 2, having two cranks, 3, projecting in the same direction, while upon the other end of the bed is mounted a pair of cylinders, 4, of ordinary construction and provided with induction valves, 5, for admitting the charge of mixed air and gas, first exhaust ports, 6, and second exhaust valves, 7. The second exhaust valves are operated by cams (not shown) in such manner and at such time as to open when the piston returns after the first exhaust takes place, and to close just in time to prevent the pistons striking them while approaching their cylinder heads. Each of the cylinders contains a piston, 8, while mounted at an intermediate point in the bed is a sliding crosshead, 9, connected by pitman, 10, with the cranks 3. Each piston, 8, is connected by a link, 11, with one end of a rocking beam, 12, which is centrally pivoted at 13 upon the sliding crosshead 9 and provided with flanges, 14, which fit accurately upon the upper and lower faces of the crosshead, while the forward faces of the rocking beam between the flanges 14 are inclined oppositely from the center, so as to permit the beam to rock upon its center 13. The operation of the engine is as follows: When the parts are in the positions shown in Fig. 1, the nearer piston is moved to the end of its cylinder and has practically expelled all of the products of combustion, while the farther piston has just completed the compression of its charge and is ready for explosion to take place. While in this position the beam has rocked on its pivot 13 until the farther end has come against the crosshead, and the explosion which now takes place will be exerted directly upon said crosshead and in a straight line through the medium of the pitman 10 to the crank shaft 2. During the compression which has just taken place, it should be noted that the charge being compressed is what rocks the rocking beam and causes the piston in the near cylinder to move to the cylinder head; but this force exerted by the compression of the charge is a yielding force, and it cannot cause impingement of the near piston with sufficient force to damage the head of the cylinder. It is therefore practicable to adjust the parts so that the piston and cylinder will come practically together. It will further be seen that when the parts are in these positions and an explosion has taken place, the outward stroke of the farther piston will uncover the exhaust port 6, while the outward stroke of the near piston, when the beam is in the position shown in Fig. 1, will move only to the position shown in Fig. 2, and will not uncover the exhaust port 6. It therefore follows that the charge which has been drawn in by the outward movement of the near piston simultaneously with the forcing of the farther piston by the explosion which is taking place, enters a partial vacuum and is therefore below atmospheric pressure, and the economy of the operation is correspondingly increased. It will further be seen the inrush of lingering products of combustion is avoided during this operation, because the discharge port 6 is not uncovered. Such being the operation of the engine during a single stroke, on the next stroke the charge which has entered the near cylinder will be compressed, rocking the beam 12 to the opposite position, and causing the farther piston to expel all the gases resulting from the explosion which has just taken place and holding said farther piston in a position which during the drawing in of the charge will not uncover the discharge port 6. In this way the operation continues, each stroke both drawing in a charge and receiving the impulse of an explosion, all of the products of combustion being expelled after each explosion, and each discharge being drawn in under expansion, without danger of return of the products of combustion.

Nine claims. Application filed Aug. 13, 1898.

No. 642,562—Jan. 30, 1900—Vaporizer for Gas Engines.—H. F. Probert, Chicago, Ill.

The third claim is here given: An explosive gas engine, having in combination a cylinder, provided with an exhaust port, a piston, an exhaust pipe connected with said exhaust port, a mixing chamber connected with said cylinder and having an air induction port, a retort chamber arranged contiguous to and heated by said exhaust pipe and having an outlet at its upper end connected with said mixing chamber, an inverted air spreading chamber located at the bottom of said retort, and having an imperforate upper side arranged normally above the oil level in said retort, but a perforated under side located normally below said oil level, and a valved pipe extending from the external atmosphere to said air chamber, and a gage on the retort extending from a point

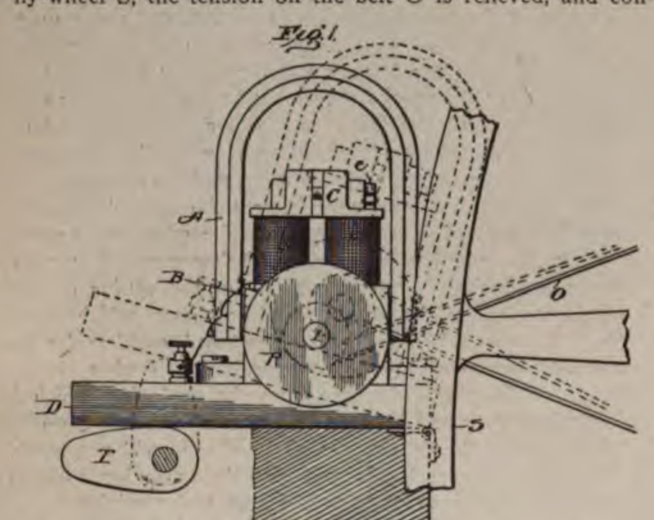
below to a point above said inverted air chamber, whereby the level of the oil in the retort may be maintained below the top of the inverted air chamber.

Three claims. Application filed March 24, 1897.

No. 643,087.—February 6, 1900. Daniel Drawbaugh, Eberly's Mills, Pa. Electrical generator for sparking apparatus of gas engines.

The inventor not only describes an improvement in sparking generators as a class, but also points out and claims a simple expedient, shown in the figure, for increasing the speed of the magneto-generator when the gas engine is started.

In the simplest embodiment the generator is mounted on a pivoted base D, and at the end of the armature-shaft, preferably adjacent the pulley N, a friction-disk R, which disk R is so positioned relatively to the fly or driving wheel of the engine (indicated by the segment S in Fig. 1) that when the generator is swung up to the position shown in dotted lines the said disk R will contact with the surface of the fly or driving wheel S, and a movement of the latter, even though relatively slow, will impart a rapid rotation to the armature. When the engine starts and attains its speed, the generator is dropped back to its normal position and will be driven by the belt O, as before explained. When the generator is swung up to throw the friction-disk R into contact with the fly-wheel S, the tension on the belt O is relieved, and consequently the latter will offer no appreciable resistance to the rotation of the armature. For swinging the generator and holding it elevated a cam or lever, such as T, may be provided, although not limited in this application to this particular means nor to any particular means for relieving the ordinary driving mechanism of the generator and throwing into action a speeding connection in starting the gas or gasolene engine.

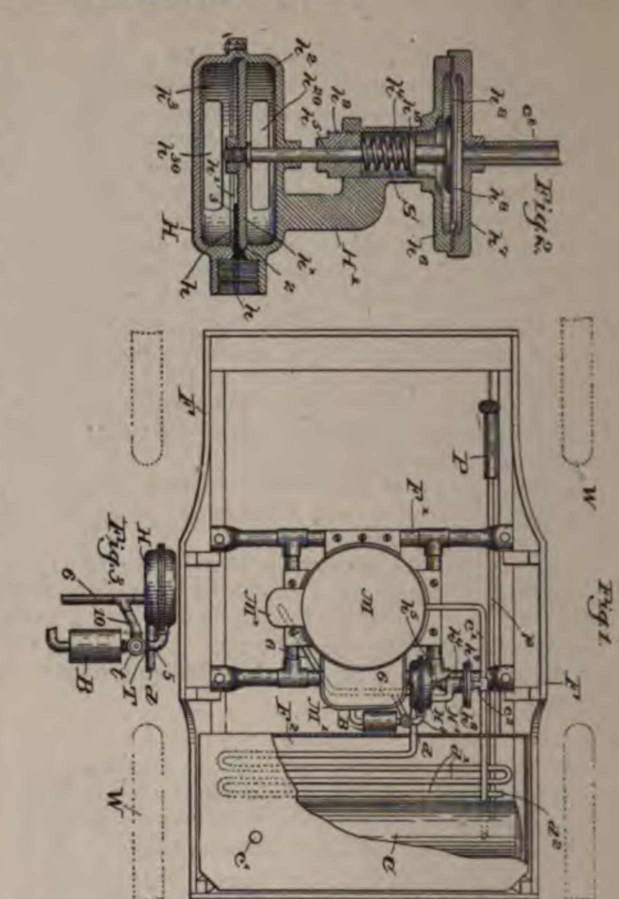


Six claims. Application filed May 6, 1899.

No. 642,771.—February 6, 1900. George E. Whitney, Boston, Mass. Motor vehicle.

Fig. 1 is a plan and Fig. 2 is a sectional view of an automatic controlling device for regulating the generation of pressure upon the liquid fuel for the motor. Fig. 3 is an enlarged detail in plan of a portion of the automatic controlling device with a by-pass and a manually operated controller therefor.

Referring to Figs. 1 and 4, a pipe d enters the feed-water tank F^2 and is connected with a series of bends d′ therein, preferably extended lengthwise thereof, the end d^2 of the bends passing out of the tank to the outer air, while the pipe d communicates with the source of the heating medium through a three-way cock T and the muffler B, if the motor-exhaust is utilized.



A pipe c′, Fig. 1, leads from the receptacle C to the furnace of the motor (not shown), at which the fuel is to be utilized and of any suitable construction, and between this pipe and the muffler B, interpose an automatic controlling device which governs the effective operation of the exhaust to generate feeding pressure upon the liquid fuel. Referring to Fig. 2, the illustrated form of controlling device comprises a preferably annular case H, having an inlet h, segmental in form, forming a part of a valve-seat h′ within the case, said seat having two opposed beveled faces 2 3 for a disk-like valve h^x, peripherally beveled, as shown, and dividing the case into two compartments h^2 h^3, having outlet-ports h^{20} h^{30}, respectively. When the valve is in the position shown in Fig. 2, the inlet-port h′ communicates with the compartment h^3, and when the valve is seated on the seat-face 3 the compartment h^2 communicates with the inlet-port, the latter being shown as connected by a pipe 5 with the muffler B. A pipe 6 (partially shown in dotted lines, Fig. 1) connects the port h^{20} with the stack or flue M^x, and the port h^{30} is connected by pipe d with the heating-bends d′. A standard H′ on the exterior of the valve-case has a tubular portion h^4 concentric with the valve-stem h^5 and is enlarged at its upper end, as at h^6, to form one wall of a chamber, the other wall being formed by a recessed cap h^7, secured to the enlargement h^6. The chamber thus formed is divided transversely

by a flexible diaphragm h", held at its edges between the parts h" and h¹ and having secured to its inner side the valve-stem h", which passes through a boss into the compartment h² and the tubular part h' of the standard H'. A nut h" is screwed into the open end of the tubular part, and between the nut and an annular flange or disk h'", fast on the stem, is interposed a spring S, the tension thereof being adjusted by the nut, said spring normally holding the valve in the position shown to close the compartment h². The compartment at the outer side of the diaphragm is connected by a branch pipe c² with the fuel-feed pipe c', Fig. 1, so that a pressure in the fuel-receptacle C greater than the force of the spring S will flex the diaphragm h" and move the valve h^x from its position shown in Fig. 2 onto the face 3 of the valve-seat h'. This operates to shut off the motor-exhaust from the bent piping or condenser d' and to turn it into the stack M^x in the present instance or to any other desired exit, the inlet h and the ports h²" h³" being made large enough to prevent any throttling of the exhaust.

As to the operation of the apparatus herein illustrated, the necessary feeding pressure on the fuel is generated by the pump P when it is desired to first start the motor, and thereafter the pressure is generated or maintained by or through heating of the liquid fuel in the receptacle C, the apparatus herein shown being adapted to heat such receptacle by the rise in temperature of the feed-water, due to passage of the motor-exhaust to the bends d'. With the controlling device herein described its normal condition is shown in Fig. 2; but when the pressure to which the fuel is subjected has arisen to a predetermined point, governed by the tension of the spring S, the valve h^x will be operated as described to shut off the heating medium from the bends d'. The fall in the temperature of the fuel in the receptacle will be accompanied by a corresponding decrease in pressure on the fuel until the spring S can operate to move the valve into its former position. It will thus be obvious that the operation of the means for heating the fuel and generating feeding pressure thereupon is automatically controlled by or through variation of such pressure in the fuel-receptacle or its connections. If it is desired to control the generation of such pressure manually rather than by the automatic controlling device described, the third port of a three-way cock T of usual construction will be connected by a by-pass 10 with the pipe 6, leading to the smoke-flue M^x, as shown clearly in Fig. 3.

When the automatic controlling device is operative, communication from the muffler to the valve-case H will be effected through the cock T, the by-pass 10 being closed thereat; but to prevent the operation of or throw out of action the automatic controller the valve-handle t, Fig. 3, is turned to close the passage from the muffler to the valve-case and to open the passage to the by-pass. The heating medium will then pass through the three-way cock to the by-pass and out through the stack, the heating means being cut out, so that there will be no operation of the diaphragm h" in opposition to the spring S, feeding pressure upon the fuel being maintained by a suitable pump.

In the automatic controlling device such a diaphragm is used as will operate with a quick snap, to thereby change the position of the valve rapidly instead of by a gradual movement.

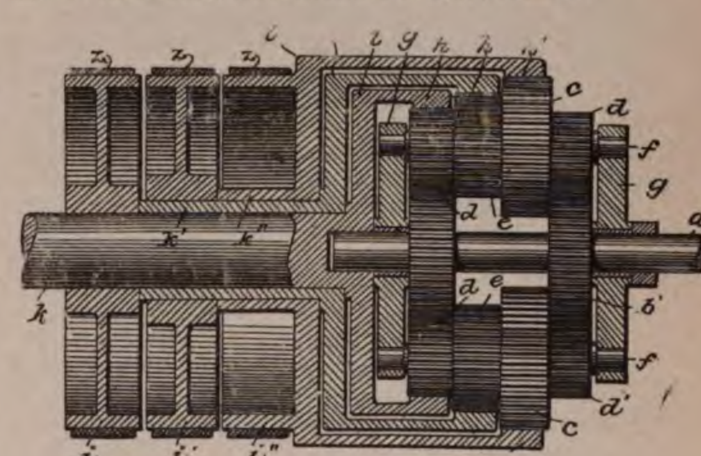
From the foregoing description it will be obvious that the heating of the liquid fuel will tend to vaporize a portion thereof with an attendant creation or generation of pressure, this pressure being utilized to effect the feed of the fuel to the combustion-point, and the pressure increases or decreases with the rise or fall of the temperature to which the main body of the liquid fuel is subjected.

Fourteen claims. Application filed February 4, 1899.

No. 642,594.—February 6, 1900. R. H. Finlay and A. H. Finlay, Belfast, Ireland. Gearing for transforming speed.

The invention relates to the transmission of power from one rotating shaft to another which it is desired to drive at a different speed in the same or the opposite direction.

Referring to the drawing, a is the high-speed shaft carrying the pinions bb'. Loosely mounted upon the shaft a, outside the pinions b and b', are two disks g g, in which are supported a plurality of shafts f, uniformly spaced apart. Upon each axle is mounted a series of gears d, e, c d', the gears d and d' meshing with the pinions b and b', respectively. The gears d, e, c, and d' on each shaft must be connected to move together, and this may be done by keying them to the shaft f and mounting the latter to turn in its bearings, or said gears may be pinned or otherwise secured to each other and turn upon the shaft. The slow-speed shaft is indicated by k, and a disk l is rigidly connected to this shaft and carries an internally-toothed ring h, with which all the gears d mesh. Another disk l' is provided with a sleeve k', mounted to turn upon the shaft k, and this disk carries an internally-toothed ring h', with which all the gears e mesh. Another disk l" is provided with a sleeve k", mounted to turn upon the sleeve k', and this disk carries an internally-toothed ring h", with which all the gears c mesh. To the shaft k and sleeves k' and k", respectively, are secured the pulleys i, i', and i".



It will be observed that the rings h, h', and h" are of different diameters, the ring h being the smallest and the ring h" the largest, and also that the gears d, e, and c are also of different diameters, d being the smallest and c the largest. The gears d' and pinion b' are provided to give steadiness and stability to the system of gearing.

Now if the shaft a is rotated the pinions b and b' will rotate in the same direction; but the gears d, e, and c will rotate in the opposite direction, their axis being assumed to be stationary, and if the rings h, h', and h" are free to move they and the pulleys i, i', and i" will all move in the same direction as the gears—that is, in a direction opposite to that of the shaft—but the speed of all the pulleys will be greatly reduced from the speed of the shaft, although not to an equal extent. The pulley i will run the slowest, pulley i' next, and the pulley i" the fastest of the three.

If a brake z be tightened on the pulley i sufficiently to hold it and the ring h against rotation, then the gears d will travel around within the fixed ring h in the same direction as the shaft a moves and will impart the same movement to the gears e and c, disks g, and shafts f. The peripheries of gears e and c are, however, traveling faster than that of gear d, and consequently they will still exert pressure on their rings h' and h" to move them in a direction opposite the movement of the shaft, but at a speed much less than when all the rings are free to turn.

If a brake z be applied to pulley i', the pulley i and ring h will be caused to move in the same direction as the shaft, while pulley i" and ring h" will still move in the opposite direction, but at a still further reduced speed, and if a brake z be applied to the pulley i" both the pulleys i and i' will move in the same direction as the shaft a, but at different speeds.

One claim. Application filed Dec. 9, 1897.

No. 642,871.—February 6, 1900. Anthony G. New, of Woking, England. Heavy oil engine.

The device consists primarily in an improved admission valve and the second of the two claims of the inventor is submitted herewith.

2. In oil-motor engines an air and oil admission and mixing device composed of a valve with a valve-rod, a truncated cone mounted about the said valve-rod and a tube, enclosing the said cone and itself inclosed in an outer tube of increasing internal diameter toward the said valve and near about the said cone, arranged so that the cone is adjustable from outside the tube as regards its longitudinal position within the tubes; the said valve, cone and tube being arranged to allow air drawn or forced within the tubes; the said valve, cone and tube being arranged to allow air drawn or forced past the valve to pass through the tube, into which oil is delivered through an orifice provided through its side, whereby the air, before passing the said valve, injects the oil through the variable space between the said cone and the said tube thereby pulverizing the oil, mixing intimately with it and forming an explosive mixture or charge substantially as described.

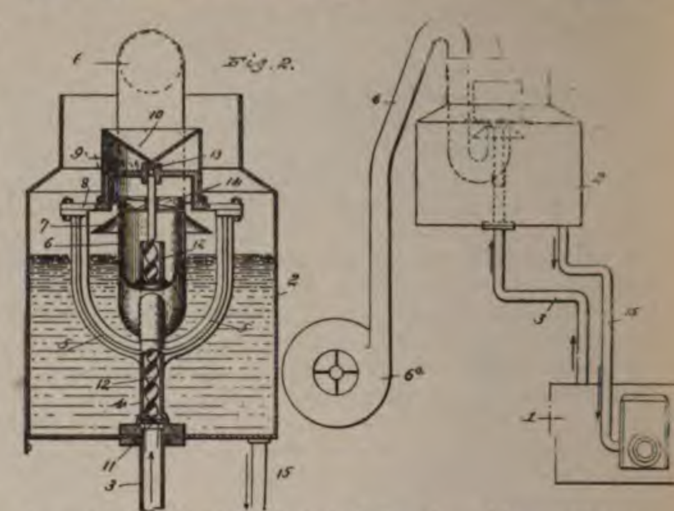
Application filed February 12, 1898.

No. 643,065.—February 6, 1900. J. W. Lambert, Anderson, Indiana. Apparatus for cooling engine cylinders.

Figure 1 is a side elevation showing a portion of an engine-cylinder, the cooling-tank, and the blower; and Fig. 2 is a vertical secional view of the cooling-tank.

Referring to the various parts by numerals, 1 designates a gas-engine cylinder which is provided with a water-jacket of any desired construction. Leading from the top of the water-jacket upward to a tank 2 is a water-pipe 3, through which the water which has passed through the jacket and become heated passes up to the tank. This tank is supported at a suitable height above the cylinder, and the pipe 3 opens therein through the bottom. Secured within the tank to the bottom thereof to register with the end of pipe 3 is a vertical tubular casing 4, which extends slightly above the water-level in the tank and is of substantially the same diameter as the pipe 3 and is practically a continuation thereof, the pipe 3 and the casing 4 forming the hot-water-conducting conduit. Carried by this casing at diametrically-opposite points are two upward-extending arms 5, which terminate above the water-level in the tank.

Surrounding the tubular casing and extending a short distance above the upper end is the inner end of the pipe 6,



through which a blast of air is driven by a blower 6^a, operated by the engine or other suitable means, said pipe carrying at its upper end the outward and downward extending deflector-plate 7. Connecting together the upper ends of the two arms 5 is a bridge-bar 8, whose center portion is raised and fits closely within the cylindrical hood 9 and is permanently attached thereto, said hood being formed with the inverted conical top 10.

The tubular casing 4 is formed at its bottom with a bearing 11 to receive the lower end of the rotary-screw water-elevator 12, and the bridge-bar 8 is formed at its center with a bearing 13 to receive the upper end of this water-elevator, said water-elevator extending through the casing 4 and serving to lift the water in said casing over into the blast-pipe 6. Secured rigidly to the water-elevator just at the top of the blast-pipe is a small motor or fan-wheel 14, which receives the blast of air and is rapidly rotated thereby. A pipe 15 leads the cold water from the bottom of the tank to the lower portion of the engine-cylinder jacket.

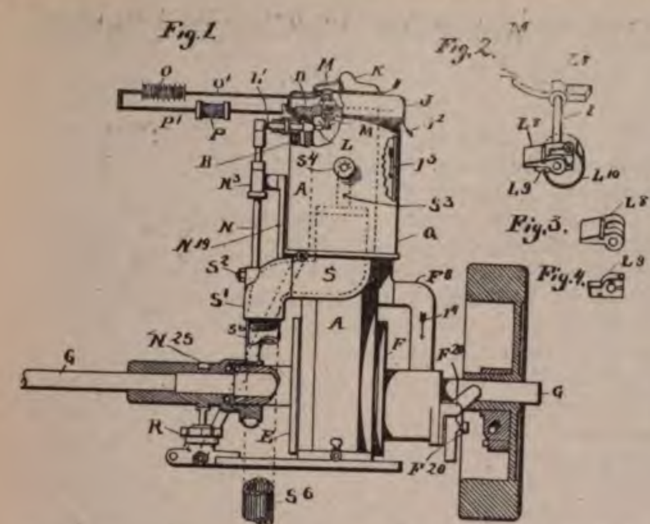
In operation the water in the tank and in the tube 4 is at the same level when the engine is not running. When the engine is started, the blower is put into operation and a blast of air is forced through the motor-fan, thereby rotating it and with it the screw water-elevator. As this elevator is operated it lifts the water from the casing 4 over into the blast-pipe, from which it is blown up through the fan and into the hood 9. From the hood the water drops to the deflector plate 7 and finally falls into the tank 2. It will thus be seen that positive means is provided for causing a rapid circulation of the water, the means for causing this circulation being operated by the blast which sprays and cools the water.

It will be observed that a feature which contributes to the utility of the apparatus lies in the fact that the blast of air carrying the overflowing water is thrown violently against the blades of the motor, whereby the water will be finely sprayed and intermittently commingled with the blast of air and thereby quickly cooled.

Five claims. Application filed April 20, 1899.

No. 643,002.—February 6, 1900. W. J. Perkins and C. H. Blomstrom, Grand Rapids, Mich. Electric ignitor for explosion engines.

This invention relates to explosive-gas engines, and has for its object to provide new and improved spark-producing mechanism which is adjustable to effect the explosions at



different periods or positions of the piston and which is simple in construction and will obtain the desired result effectively and certainly.

Figure 1 is a side elevation of an explosive-engine constructed in accordance with our invention, with parts cut away for the purpose of showing the internal arrangement of the mechanism in detail. Figs. 2, 3, and 4 show detailed views of the spark-producing device. For the purpose of securing a quick break to produce an efficient spark provide a projecting contact-arm L^7 on one end of the electrode L, and on the other end of L we provide two arms. One of these arms (shown by L^8) is keyed or otherwise rigidly connected to the electrode L, while the other arm (shown by L^9) has an oscillating motion and is raised by the contact-point of the spark-actuating rod. A spring L^{10} is shown in Fig. 2. The form of the movable arm is shown clearly in Fig. 3, and the form of the arm which is keyed to the electrode is shown in Fig. 4. The arm L^8 extends beyond the arm L^9 and forms the contact-point for a dog on the actuating-rod N. The rod N is moved by an eccentric, as hereinafter described, and contributes a vertical vibratory motion to two contact-points. One is shown by N^4 and the other by N^5. When the actuating-rod N is moved upward, one of the contact-points comes in contact with the free end of arm L^8, which arm being attached to the electrode L, as above described, turns the electrode-arm L until the electrodes are in contact, and the continuous upward movement of actuating-rod N continues the contact of the electrodes under increasing spring-pressure until the free end of the spring-arm L^9 escapes from the point N^4, when the spring L^{10} carries the free end of the arm L^9 down, giving a quick blow or stroke on the arm L^8, which is rigid with L, oscillating or rocking the same a sufficient distance to separate the electrodes and producing a most efficient spark for igniting the gas in the compression-chamber. Thus the electrodes are brought together by a comparatively slow motion, are held together by an increasing pressure, and are separated by a quick stroke. The spring L^{10} may be of any suitable form to enable the described action to be secured between the two arms L^8 and L^9. It will be noted that this arrangement of parts eliminates all friction on electrode L, as there is no outside tension applied thereto. The actuating-rod N is operated by an eccentric preferably, although other mechanism would give substantially the same movement to it. The lower end of the actuating-rod N fits in a suitable socket N′, formed in a projection of the eccentric-strap N^2, which eccentric-strap is actuated by an eccentric on the crank-shaft G. Toward the upper end of the actuating rod N said rod has a sliding bearing pivoted at right angles to the rod N, the pivot being shown in Fig. 1 by N^3. The pivot N^3 is supported in journal-box on arm N^{19}, which is preferably fastened to the cylinder. The bearing or sleeve is rocked or oscillated by movement of the actuating-rod N as it is moved by the eccentric, causing the upper end of the actuating-rod to describe an ellipse, the major axis of which in the example of our invention would be the throw of the eccentric, while the minor axis would depend upon the relative position of the pivoted bearing upon the actuating-rod to the dogs N^4 and N^5. If, however, the pivoted bearing be placed nearer the lower end than the upper end of the actuating-rod, then the major axis would be horizontal and the throw of the eccentric would be the minor axis. By changing the position of this pivoted bearing the movement of the upper end of the actuating-rod may be varied at pleasure. Any suitable battery, as O, may be used. Attached to coil P are wires O′ and P′, with binding-posts and electrode-points M and L^7.

Eleven claims. Application filed Dec. 9, 1897.

No. 643,595—Gearing for Automobile Vehicles.—Leonard Huntress Dyer, of Washington, D. C., assignor of one-fourth to Frank L. Dyer, of Montclair, N. J. Application filed Aug. 30, 1899.

This invention is intended to be used in connection with a motor of the explosive or internal-combustion type; but any type of form of motor may be employed.

The invention is intended to be applied directly to the supporting axle without the interposition of chains or other gears; but where the exigencies of the case demand any form of transmitting gear may be added.

The gear comprises, essentially, two parallel shafts, the driving one being preferably a continuation of the engine shaft, the driven shaft being the supporting axle. The driving shaft carries a pinion, which pinion is capable of longitudinal movement along the shaft and is secured thereto by means of a feather or its equivalent. Means are employed for sliding the pinion. The driven shaft carries two gears of identical diameter, face, and pitch. These gears are arranged upon the shaft side by side, with a separating interval. The pinion on the driving shaft may engage with either or neither of these gears, as will depend upon its position upon its supporting shaft. One of the gears is supported upon the driven shaft and serves to drive the same at its own rate of speed, and the other is connected to the same shaft by an interposed epicyclic train, which reduces the speed of the driven shaft proportionately, as will be described.

A frictionable, yieldable, disengageable fulcrum is arranged in connection with the epicyclic train, so that it may be gradually brought into use.

The second gear, with its attached epicyclic train and yieldable fulcrum, form together the starting or slow-speed gear. The first gear forms the high speed, the pinion being shifted to engage with one or the other, as desired. When the high-speed gear is in use, the low-speed gear, together with its epicyclic train, turns as an entirety and causes no noise, nor does it consume power by friction.

The invention further relates to means whereby the engine may be started by the ordinary trycicle pedals, and also to means whereby the vehicle may be propelled by the pedals, either exclusively or as an auxiliary power.

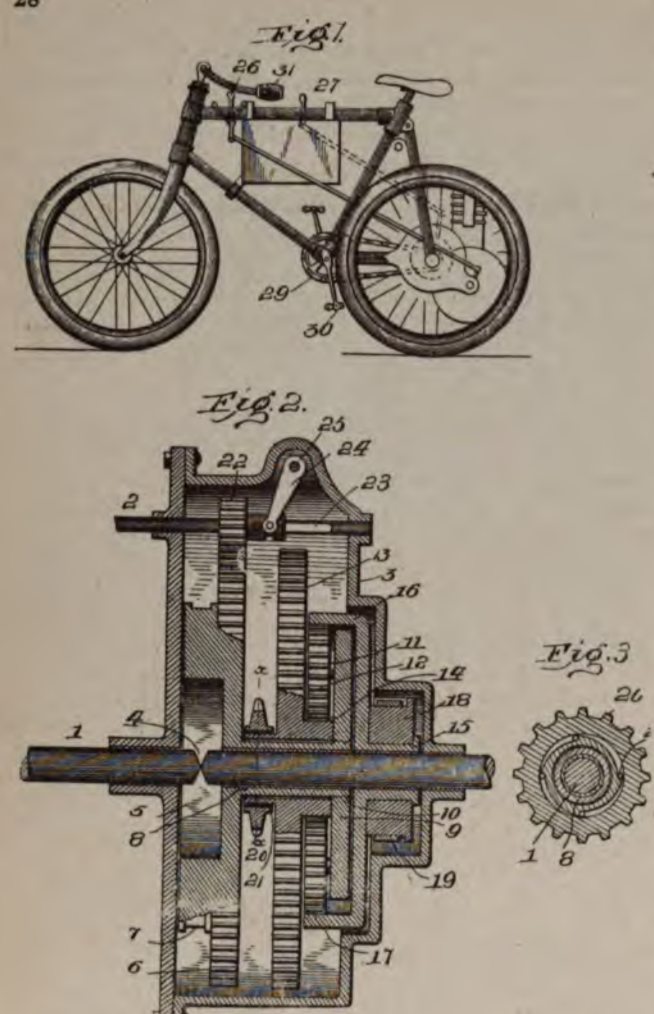


Fig. 1 is a side view of an automobile tricycle embodying my improvement. Fig. 2 is a view, partly in section, of the bridge of the rear axle, and of the gears; and Fig. 3 is a section of the sprocket and clutch, taken on the lines x x of Fig. 2.

The driven shaft or supporting axle 1 is maintained parallel to the driving or engine shaft 2 by the casing 3.

The sleeves which support the axle 1 may be continued out to a point adjacent to the hubs of the driving wheels or they may be of but sufficient length to contain the inside bearings, the outside bearings depending from a bridge, as is the well-known practice.

The axle 1 is interrupted at 4, where is located the differential. The latter is not shown in the drawings, as it would tend to confuse, but it is of any well-known type and is connected to the inside of the gear box 5. The latter is provided with working teeth upon its periphery, which form the gear 6, and with a drum, 7, upon which engages the main band brake, as will be understood.

No. 642,777.—February 6, 1900. J. C. Anderson, Highland Park, Ill. Autotruck wheel.

A metal wheel struck up out of sheet steel, with an opening for a hub of steel tubing in the center. Holes are cut in the rim so that pressure on the tire will force the rubber into the perforations and prevent a creeping of the tire.

Two claims. Application filed August 25, 1899.

"Yale" Improved Two-Cycle Engines.

This engine is the result of five years of painstaking investigation on the part of Joseph W. Denison, an electrical and mechanical engineer of New Haven, Conn.

The crank shaft is forged from the solid, and carefully counterbalanced. M is a rotary valve plate, which in use slips over the end of this crank shaft and fits loosely on a boss made to receive it. The plate M is driven positively by the small pin R, shown on the left-hand crank throw, and is spring seated on the crank case cover C, shown at the left of fly wheel. As the crank revolves (in a spray of oil, which gives perfect lubrication to all the moving parts), this plate M opens and closes the suction port S and transfer port A with absolute certainty, eliminating the sensitive and unreliable suction lift valves almost always used in this type of engine, and also preventing the charge, while being compressed in the base, from blowing up the transfer pipe and around the sides of the piston, and out of the exhaust port D, as the packing rings on the bottom of the piston cannot prevent this side leak, which is another cause of failure in many two-cycle engines. As soon as a piston wears even a small amount, this leakage is bound to take place, and is sure to produce loss of power, and even prevent the engine from running unless provision is made for preventing it. This rotary valve M is subjected to only nominal wear, as the compression in the crank case does not exceed 15 lbs., and only cold charge and oil come in contact with it. The valve M also is so arranged that it makes a perfect seat, and would continue to do so even should the crank shaft wear badly out of line. A feature of great importance is the constant down thrust, which is in marked contrast to engines of the four-cycle type. In four-cycle engines, Mr. Denison states, the slightest lost motion in the connecting rod or bearings requires instant adjustment at the hands of a competent mechanic; otherwise the engine will pound itself to pieces, while in this engine, the thrust always being down, there is no pounding, and no damage will result, even after parts and bearings are badly worn in years of service. Stuffing boxes at the ends of bearings or baffle rings on the crank shaft are provided, according to the type of engine, so that the charge cannot leak out, no matter how much the bearing and shaft should wear.

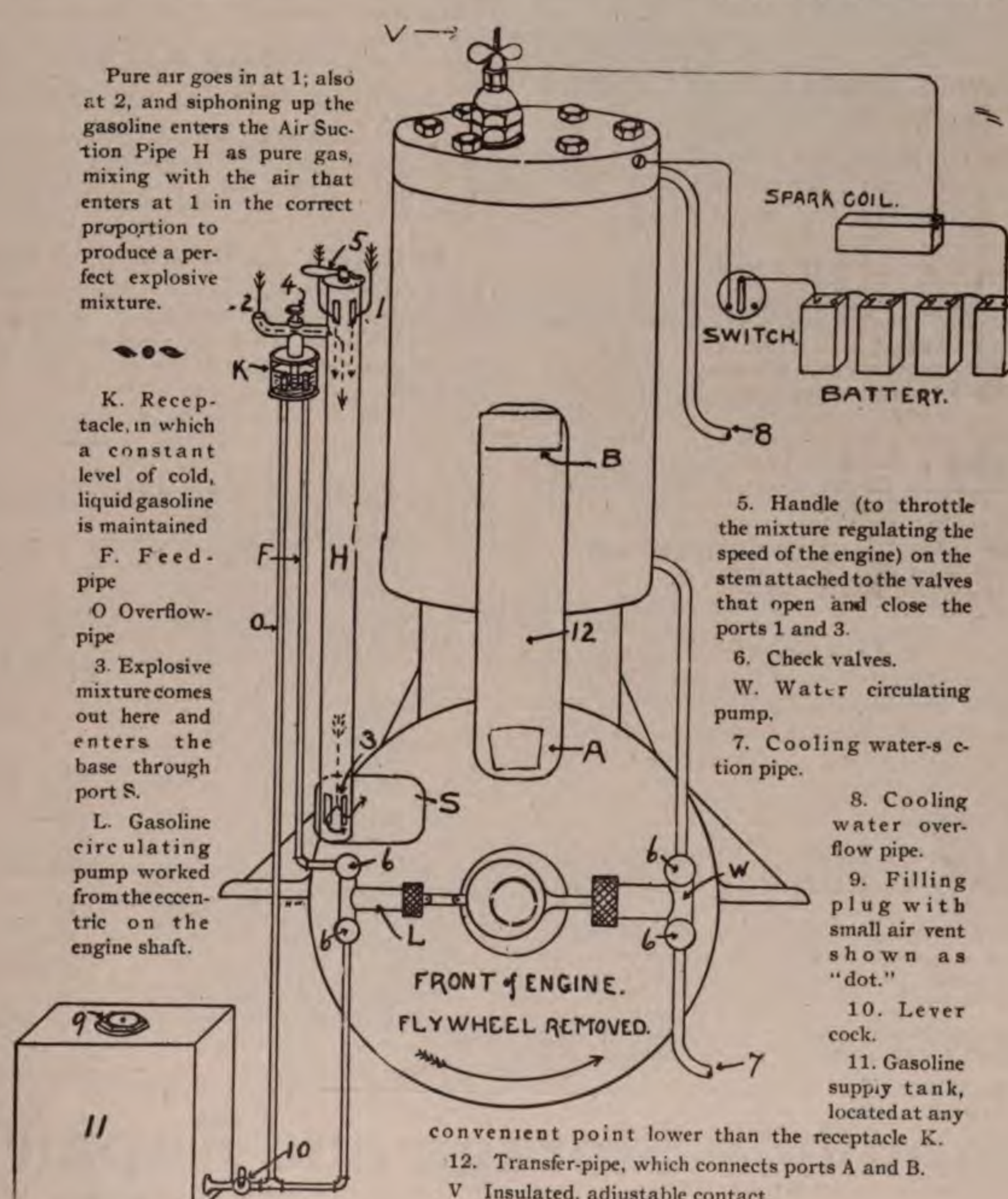
The system of vaporization consists essentially of a supply tank, 11, which is somewhat lower than the receptacle K, and a gasoline circulating pump, L, which, while the engine is running, pumps a small amount of gasoline into the receptacle K, attached to the air suction pipe H. In order to make this reliable, the pump L pumps faster than the gasoline is used, the surplus flowing back into the tank. This results in an absolutely even height of gasoline in K, irrespective of vibration, and, as there are no valves in this receptacle, there is nothing to get out of order.

As the air is sucked into the suction pipe H, through openings 1 and 2, it siphons up the exact amount of gasoline, which is adjusted by a micrometer screw, 4, and one adjustment only is necessary for a given engine.

The speed of the engine is controlled by two throttling valves on one stem, operated by the hand lever 5, or by an automatic governor, as desired, and these valves so adjust the flow of air that the proper amount of gasoline is siphoned up to make a perfect explosive mixture under all conditions, whether light or heavy explosions, slow or full speed, hot,

cold, damp or foggy weather. No change or adjustment is required from summer to winter running, as the explosive mixture is further mixed, and also warmed, by the violent agitation it receives in the crank case, previous to its transfer to the top side of the piston, and subsequent compression before the explosion takes place. This method also admits of the use of less volatile and cheaper grades of gasoline than can be employed where the carbureting system is used.

The sparker is of the make and break type, with an adjustable and instantaneous snap motion, which is worked from the outside of the cylinder by a simple connection from the eccentric which operates the gasoline and water circulating pumps. The adjustment or timing of the spark can be regulated to a nicety while the engine is running.



Pure air goes in at 1; also at 2, and siphoning up the gasoline enters the Air Suction Pipe H as pure gas, mixing with the air that enters at 1 in the correct proportion to produce a perfect explosive mixture.

K. Receptacle, in which a constant level of cold, liquid gasoline is maintained

F. Feed-pipe

O Overflow-pipe

3. Explosive mixture comes out here and enters the base through port S.

L. Gasoline circulating pump worked from the eccentric on the engine shaft.

5. Handle (to throttle the mixture regulating the speed of the engine) on the stem attached to the valves that open and close the ports 1 and 3.

6. Check valves.

W. Water circulating pump.

7. Cooling water-s c-tion pipe.

8. Cooling water over-flow pipe.

9. Filling plug with small air vent shown as "dot."

10. Lever cock.

11. Gasoline supply tank, located at any convenient point lower than the receptacle K.

12. Transfer-pipe, which connects ports A and B.

V Insulated, adjustable contact.

G. Spark contact-breaker.

DIAGRAM AND MODUS OPERANDI OF THE DENISON TWO-CYCLE GASOLINE ENGINE.

WINTON MOTOR CARRIAGE CO., EASTERN .... DEPARTMENT.

CARRIAGE ON EXHIBITION AT

120 BROADWAY, NEW YORK.

CORRIDOR, EQUITABLE BUILDING.

OPPORTUNITY TO TEST IN NEW YORK BEFORE PURCHASING.

THE

GEOMETRIC LINE

Of tools for screw machine work are used and recommended by all leading manufacturers because they possess so many points of superiority over old methods.

If you are interested in screw machine work of any kind it will pay you to investigate this line of

Adjustable Self-Opening Screw Cutting Die Heads,
Adjustable Collapsing Taps, and
Adjustable Hollow Milling Tools,

Manufactured by the

GEOMETRIC DRILL CO.,

Westville, Conn., U. S. A.

DESCRIPTIVE MATTER ON DEMAND.

"NEW CENTURY" PRIMARY AND STORAGE BATTERY AND DYNAMO GENERATOR.

MOTOR IGNITION SETS with spark coils in boxes ready for use

FOR GASOLINE MOTOR-VEHICLES.

DRY BATTERY STARTING SETS.
A—12 cells. Size, 8 x 20 x 9. B—24 cells. Size, 11 x 26 x 9.

SELF-EXCITING DYNAMO SET.
Produces constant current. C—complete with pulley, 8 x 10 x 12.

CLOSED-CIRCUIT SOLUTION BATTERY SETS.
For continuous ignition. D—6 enameled cells, 150 A. H. 10 x 16 x 9. E—6 glass cells, 300 A. H. 11 x 18 x 10. F—6 rubber cells, 300 A. H. 11 x 18 x 10.

STORAGE BATTERY SET.
G—3 rubber storage cells, 18 Ap. hrs. 6 x 8 x 10.

This Starting Set and the Dynamo will eliminate all "battery troubles" and give the most satisfactory reliable and economical service obtainable.

The Solution Battery Sets are designed for motor vehicle use and have coils wound especially to save the current for mechanical contact ignition or with "Ruhmkorff" coils if ordered. Any set furnished without coil if desired. Special prices to manufacturers in any quantities. Full information on application.

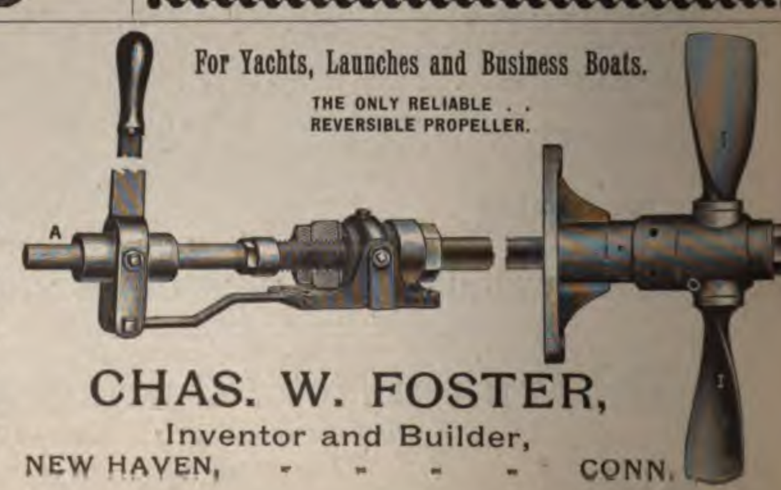
LOUIS H. ALLEN, SPECIAL AGENT,
2427 MICHIGAN AVE., CHICAGO.

FOSTER'S PATENT REVERSIBLE SCREW PROPELLER.

HAS Balanced Ball Thrust, Perfectly Noiseless, No Cog Wheels to rattle and break. Stronger than a Solid Propeller, and gives better results. In use by up-to date Gas Engine Builders. **Catalogue and Order Blanks on Application.**

For Yachts, Launches and Business Boats.

THE ONLY RELIABLE . . REVERSIBLE PROPELLER.



CHAS. W. FOSTER,

Inventor and Builder,

NEW HAVEN, - - - - CONN.

LET US SEND A LITTLE FOLDER
TELLING ALL ABOUT THEM. . . .

Branches in every City in U. S.

Consolidated Rubber Tire Co.

40 WALL STREET, NEW YORK.

SPECIAL OFFER.

BACK NUMBERS.

We have no more complete files and have decided to offer miscellaneous back numbers of THE HORSELESS AGE, from December, 1895, to March, 1899, at the following prices:

6 ASSORTED, - - - - - 50 CENTS.

THE HORSELESS AGE,

American Tract Society Building, **NEW YORK.**
Nassau and Spruce Streets,

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. V. NEW YORK, FEBRUARY 28, 1900. No. 22.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

Acetylene Number.

There is apparently a good deal of interest in acetylene among motor vehicle students and experimenters. Since the acetylene promotion fever attacked us several years ago, the usual lull has been experienced. The promoters retired with their speculative gains and left the real development of the field to the patient experimenters and legitimate investors, to whose persistent efforts we owe the upbuilding of every new industry. These earnest and conscientious workers are generally too busy to make much trumpeting in the world, and for this reason the substantial progress they make is apt to be overlooked. Some who have followed recent developments claim that the cost of manufacturing calcium carbide has been so reduced that its utilization for vehicle motors, so far as cost is concerned, is already practicable. In regard to the special form of motor required to successfully control the new explosive, little is known. Attention has chiefly centered upon the cheaper and more available hydrocarbon gasoline, for which suitable motors were already perfected. Possibly the time has arrived when sufficient practical data may be gathered relative to the use of acetylene in vehicle motors to warrant an attempt to more clearly define its nature, properties and general availability for the purpose. We therefore announce for some date in May, to be decided upon later, an Acetylene Number, in which we shall endeavor to show what has been accomplished in the application of this fuel to vehicle motors and what is likely to be accomplished in that direction.

Standard Sizes.

Since we have been publishing The Horseless Age we have had scores of requests for information in regard to the standard sizes of axles, wheels, tires, etc., etc., which manufacturers of motor vehicles had adopted. These requests have generally come from individuals or firms contemplating the manufacture of motor vehicle parts. In every case we have been compelled to refer the inquirer to the motor vehicle publications and the catalogues of the various manufacturers for information. There are no standard sizes yet. The industry is too experimental, and many of those who are now building are erring on the side of lightness. Hence, the only course for the investigator to take is to read up on the industry, study the strains and the tables of strength of materials and come to his own conclusions. The experience of those who have several thousand miles of road work to their credit will be extremely valuable, but after all available helps are exhausted there will still be room for intelligent judgment in forming an opinion at this stage of the industry.

Odorless Vehicle Motors.

The reply of Mr. Bronson, printed elsewhere in this issue, to our criticism of his former letter on acetylene as a fuel for vehicle motors, seems to overlook a point very little regarded by manufacturers of "odorless" vehicle motors. We refer to the difference between running a motor at uniform speed in a

shop and running it on a vehicle under the varying conditions of such service—i.e., stopping, starting, changes of speed, temperature, etc. At normal speed a motor may run without appreciable odor, but in stopping and starting an occasional imperfectly combusted or wholly uncombusted charge will be expelled and cause odor. In properly constructed motors this does not occur often, and the odor nuisance is reduced to a minimum; but the absolutely odorless hydrocarbon vehicle motor we have never seen, nor do we believe such a motor exists. The character of the work is too variable to make it possible.

This statement we also believe to be generally true, whatever the hydrocarbon employed, for the irregularity of operation of the motor is not changed with the fuel. We see no reason to believe that acetylene vehicle motors, whatever advantages they may possess, will be absolutely odorless.

Skepticism Leads to Knowledge.

The period of bluff and deception in the motor business is passing by. Henceforth those who seek the confidence of the public will be compelled to demonstrate their claims, to exhibit and explain the mechanism of their vehicles and convince the purchaser that the facts are as represented. This growth of skepticism is the inevitable result of the wholesale misrepresentation of which the promoters of the movement have been guilty. It is well that it is so. Doubt is the beginning of wisdom. The worst customer a motor carriage manufacturer can have is a hare-brained enthusiast, who in his impetuosity is quite certain to hurt himself and the industry too.

One inventor who is soliciting motor trade has had a complete working model of his motor made in pasteboard, showing all the parts and the cycle of operation and giving full descriptive details. His example is worthy of emulation. Merit shows best in the light. Humbugs prefer darkness and concealment.

Automobile Owner's Insurance.

Insurance companies that have undertaken personal liability insurance for owners of motor vehicles report that the percentage of accidents is so high that they are hesitating about continuing this class of insurance. The hazardous character of the risk is ascribed to two causes—runaways and reckless driving by inexpert or over-enthusiastic automobilists. The companies that assume these risks have the figures to guide them and reduce their business to a science. If automobile insurance is extra hazardous it is largely due to the carelessness of those who use them. Excessive speed is probably the most prolific cause of accidents. Put on the brakes!

Flagrant Misrepresentation.

Lead Cab drivers in Boston and New York have received orders to limit their mileage on one charge to 7 or 8, so that they will be more likely to get home again when they go out. Yet in the face of these and other facts, the storage battery Ananias continues to talk of 30 or 40 miles on one charge as a regular performance of the electric vehicle. The claims of American electric vehicle promoters afford the most flagrant examples of misrepresentation to be found outside of the records of the police courts.

Gaining Power.

It is astonishing how many honest mechanics are wasting time and money on transmission devices which will enable them to gain power instead of losing it. Every time we convert or apply motive power we lose some of that power by the operation, whatever method of transmission we may adopt. Inventors of lever devices to transmit the power of a motor to the wheels of a vehicle in multiplied ratio should brush up on their mechanics.

Dynamometer Tests.

We are not aware that any thorough dynamometer tests of vehicle motors have ever been published in any of our American journals. This is the sort of information that is most needed at the present time, however, and we shall soon lay before our readers complete tests of a well-known motor which will tend to show that an actual horse-power will do a great deal more work than it is credited with in most of our makers' catalogues. A horse-power is the force required to raise 33,000 lbs. 1 ft. in one minute, a truth which needs frequent emphasizing.

"A Watery Grave."

"The mountain labors and a little mouse is born." The much-talked-of $200,000,000 automobile trust is at last announced. The Lead Cab and the Anglo-American trustlets are to consolidate, so the newspapers say, and try to keep each other's spirits up in the midst of the deepening gloom. They are well mated, and we hope the work of consolidation will go on until all promoters of this stripe in their drowning frenzy grapple each other and go down together to a watery grave, "Unwept, unhonored and unsung."

Hot Tube Versus Electric Ignition.

By Herbert L. Towle.

The hot tube occupies an earlier place in the evolution of the gas engine than the electric spark. It is so ideally simple, as regards both construction and care, and so uniformly reliable under any ordinary conditions, that the preference given it has been obvious and natural. Being surrounded by flame, it does not, like the electric sparker, need to be protected from the heat within the cylinder. It can be fouled only by an inordinate excess of oil. Its timing is practically invariable. It has no hidden or mysterious weaknesses, and if made of platinum or nickel alloy it is almost indestructible.

The user of an electric igniter, on the other hand, must be something both of an electrician and of a mechanic to care for it intelligently. Battery exhaustion, corroded wires, short circuits anywhere from battery to contact points, "grounds" and fouled or worn contacts, are a few of the infirmities common to the class; and each type has its own pet ailments besides. The jump spark igniter will get out of order most often from the difficulty of confining the high potential secondary current. The wipe sparker is not readily fouled, but its timing is apt to be affected by wear, and the tips need frequent renewal. The lift sparker, if the contact is broken by the piston or by the rise of a cam, is sluggish, and at moderate speeds requires a heavy current. It has the fatal defect of giving its poorest spark when a strong one is most needed, namely, when starting the engine; and it should never be used where portability and battery economy are important. The quick-acting lift sparker, with contact broken by a snap cam or trigger release, is the most complex type of sparker. It gives a uniformly good spark at all speeds, however; it is very economical of current, and if it gets out of order it is usually outside the cylinder and not inside. It does not lose its correct timing by wear, as the piston lifted and wipe sparkers nearly always must, and, when once adjusted, it may be left indefinitely.

Nevertheless, even the most perfect electric igniter has many more ways of getting out of order than a hot tube; and if the only drawbacks to the latter were the cost of keeping it hot by an external flame and the perhaps rather imaginary danger from fire, it is doubtful if such persistent attempts would be made by the builders of motor carriages and launches to improve the electric igniter, to the neglect of the hot tube. But the real obstacle to the employment of the latter on vehicle motors is that the high-speed gas engine demands a considerable lead in its ignition, and by preference one that is automatically variable for different speeds; and this the hot tube cannot give. Less than could be wished is known concerning what actually takes place in the tube at each point of the cycle; but it is now believed that the fresh mixture reaches the heated portion of the tube and is ignited considerably before the end of the compression stroke. The flame is then prevented from striking back into the cylinder by the continued inflow of fresh mixture, and the flame only reaches the mouth of the tube when the inflow becomes slower than the rate of flame propagation—i. e., when the compression stroke is near its end. It is known that the external flame can, without pre-ignition, be applied to the tube at a point which calculation shows must comparatively soon be reached by fresh mixture; and this fact is taken advantage of to relieve the compression somewhat when starting the engine.

This action within the tube has the effect of causing inflammation of the mixture to begin shortly before the crank reaches the center, with almost any moderate speed of rotation. Unfortunately, the inflammation tends to lag as the speed increases; and at high speeds it is nearly impossible, with tubes of the usual proportions, to get it started soon enough to insure complete combustion before the mixture has expanded too far. Naturally, these phenomena are most marked with long tubes, and by making the tubes sufficiently short the velocity of inflow may be reduced to any desired extent, and inflammation begun at a point correspondingly early. This is the method adopted by a prominent firm of launch builders, which employs tube ignition and high speed; but in practice it is extremely unsatisfactory. In proportion as the tube is shortened, the time when inflammation begins becomes less and less self-regulating, and at length depends solely on the degree of compression and the richness of the mixture. Consequently, anything which affects the compression, such as a dry piston, clogged inlet pipe, change in spring on inlet valve, or even a change in speed when the piston is drawing air rapidly through a constricted opening, or any change in the mixture, such as half a dozen things may cause, will result in an ignition either too early or too late, or in no ignition at all. Moreover, the operation of starting becomes a very delicate one, and it is not unknown for the victim of this arrangement to be projected over the side of the boat, or out through a window, when trying to hurry the crank over the center against a "too previous" explosion. This defect could be corrected by a timing valve to open and close the mouth of the tube, and in England these are much used on stationary engines. They have found little favor in this country, however, and for vehicle service, at least, it is doubtful if any form could be devised whose advantages would overcome the defects of its added complexity.

It is often thought that the hot tube gives a more "certain" ignition than the spark, and it is unquestionably easy to find cases in which the inflammation propagates more rapidly from the tube than from the spark. This is probably attributable to the relatively large igniting surface presented by the former, as compared with the minute dimensions of the spark; but the energy of the spark has much more to do with the rapidity of combustion than is sometimes supposed. It is well known that a poor mixture requires a strong spark, but it is not so commonly understood that a spark which is quite sufficient at slow speed will fail to burn the charge fast enough when the engine's speed is considerably increased. Within limits this can be compensated for by increasing the lead; but the lead, while necessary, should, for the best efficiency, be no greater than needful; and it may be set down as a rule that all high speed gas engines should have a strong spark.

We see, therefore, that, despite its simplicity and dependableness, there are other reasons for the hot tube's disbarment from vehicles than the fear of our feminine chauffeuses lest they be "blown up" in the midst of their sport. For the reasons given, only the most efficient types of sparkers can be justified in its place; but the logic of the situation points to the development of the electric igniter, in spite of the problem it presents, rather than to the retention of the simpler but less adapted hot tube.

The Theoretical Expansion Curve.

By E. C. Oliver.

In reply to the inquiry of E. J. Stoddard concerning "The Gasoline Engine Indicator Diagram," as to the reason why 1.41 was used as the exponent in the theoretical equation for the expansion and compression curves, I would say that this number is the ratio of the specific heat at constant pressure to the specific heat at constant volume for most of the permanent gases, and a curve traced according to the formula $p. u.^{141} = \frac{p. u.^{141}}{1' \, 1'}$ will represent a true adiabatic expansion for those gases.

How nearly this exponential equation will represent the action of the gases in which we are interested—those in the gasoline engine—is not perfectly well understood.

For a mixture of gas, air and exhaust products, such as occurs in a gas engine before explosion, this ratio is computed to be 1.39. For the mixture after explosion, consisting of carbonic acid, oxygen, nitrogen and steam, the ratio, as computed, is 1.37, and we are told that these values may be slightly greater for gasoline. Consequently, for want of more exact information concerning this point, 1.41 is used, which value cannot be much in error.

An exponent may be determined for any given case by which a curve may be constructed approximating the actual curve of forward pressures, but it is a well-known fact that in a gas or gasoline engine the combustion of the charge is not instantaneous—that it continues for a portion of the forward stroke—and this expansion cannot be represented by any fixed exponential equation, because it will vary with circumstances.

The expansion during the early part of the stroke being more nearly isothermal, the exponent will be nearer unity, and a curve which approximates the entire pressure line will have an exponent lower than 1.41.

It is, I think, preferable to use the theoretical exponent and correct the diagram, as was explained, rather than adopt any rule which will be only approximate in any case.

There is, however, no reason why some other value should not be used when it is determined positively that it is more nearly correct than 1.41.

The following table, taken from "The Gas Engine," by Dugald Clerk, gives the specific heat at constant pressure, the specific heat at constant volume, and the ratio for most of the gases concerned in the gas engine.

	C p Specific heat at Constant pres.	C u Specific heat at Constant volume	$K = \frac{C p}{C u}$
Air	.237	.168	1.413
Oxygen	.217	.155	1.403
Nitrogen	.244	.173	1.409
Hydrogen	3.409	2.406	1.417
Marsh gas	.593	.467	1.30
Ethylene	.404	.332	1.144
Carbonic oxide	.245	.173	1.416
Steam	.480	.369	1.302
Carbonic acid	.216	.171	1.165

COMMUNICATIONS.

More of Acetylene.

Ottawa, Feb. 22.

Editor Horseless Age:

I note in your issue of Feb. 14 your criticisms on my advocacy of calcium carbide as an ideal power for horseless vehicles. Your reference to the tremendous explosive force of acetylene and the fatal results following experiments therewith some three or four years ago, must refer to liquid acetylene, and not to acetylene gas, as generated from the carbide, as it has no application whatever. Be good enough to keep in mind that my remarks bear upon present conditions and not upon those of four years ago, as great changes have taken place in this field during that period. I quite agree with you, if your reference is to liquid acetylene, that it is desperately dangerous, and, as you are probably aware, it is not allowed within the limits of your own city.

I fail to see wherein my "remarks on the odor of gasoline would probably apply as well to acetylene." I was very explicit in my statement that the proportions of acetylene gas and air best suited for motor purposes are fortunately those which, upon being exploded, give off no odor; and if no odor results from the explosion there can of course be no odor from the exhaust, which you mention as not being clear to you.

As you suggest, "Certain proportions of gasoline vapor and air may produce practically odorless combustion;" but such are evidently not the proportions made use of by gasoline vehicles, as it is generally admitted by bystanders that a very unsavory trail follows the passage of such vehicles.

You speak of the heat generated from an explosion of an acetylene mixture as being so much more intense than that resulting from the explosion of a gasoline mixture that motors of special construction would undoubtedly be necessary. I have had no practical experience in this matter, but it seems reasonable to assume that if the acetylene gas mixture is so proportioned as to yield at each explosion the same amount of power as that obtained from explosions of any given gasoline mixture, then the heat generated should be no greater.

As evidence of the opinion of others in this connection, I quote the following from other publications: "According to experiments made in France, acetylene for motors is less convenient to renew than petroleum, but has the marked advantage of greater cleanliness, the impossibility of accidents through fire, and the absence of odor from the exhaust."

And again: "The praiseworthy attempt of M. Jeanteaud, in the Paris-Bordeaux race of auto-locomotors, to develop this line of progress, has been helpful in many ways. The last entry, acetylene, yesterday a scientific curiosity, to-day a commercial product, seems marvelously adapted to solve the problem of auto-locomotion. * * * As regards the absence of dead weight, petroleum can alone compete with this wonderful product." Very truly yours,

W. G. BRONSON.

No Standard Sizes.

Toledo, O., Feb. 22.

Editor Horseless Age:

We are designing for the automobile trade and investigating the points necessary to cover a roller bearing hub. We

lack one bit of information, which, if you could furnish us, would be greatly appreciated. What we want to know is the size axles used in the front and rears for the different vehicles now on the market. We know there must be variation. Whether there be a standard on this point or not is what we would like to know; also the spread of the flanges for the different size wheels. We trust we are not exacting in our questions; but as your paper seems to be one of the principal trade exponents, we know of no better way of getting information than in this way. Yours truly,

MEILINK MFG. CO.

[There are no standard sizes yet. Generally speaking, the axles employed at present are too small to stand the strains. Probably 1¼ to 1⅝ would be a fair average for single-seated rigs. The investigator can only gather all the data he finds and then use his own judgment. The art is experimental and mistakes are numerous.—Ed.]

Ignition Queries.

The following is in answer to a letter recently received from the Carley Iron Works.

"How many volts of electricity will it require from a storage battery, with a good spark coil, to ignite a gasoline engine 300 to 500 times per minute?"

This would depend upon the coil. We should not use less than two cells in series—4 volts.

"What is the best material for the core of a spark coil?"

The iron used by photographers for tintypes. Core wire is frequently used. The iron should be soft and homogeneous. The laminations, or wires, should be slightly insulated from each other, as by covering them with shellac.

"Does the current from the battery go through the coil from the core to the outside or from the outer layer toward the core?"

It makes no difference either way.

E. J. STODDARD.

Hydrogen Gas as Motor Fuel.

Jersey City, N. J., Feb. 20.

Editor Horseless Age:

I wish to ask what might be the possibilities of pure hydrogen gas, mixed, of course, with the proper proportion of air, as an explosive mixture for gas engines for automobiles. I have been experimenting on the production of this gas, and I have developed a method of generating the gas very easily and cheaply, and the apparatus could be easily placed in the smallest carriage. I intend to try this on a carriage as soon as possible.

JAMES J. COOK.

Power and Leverage.

Chicago, Feb. 19.

Editor Horseless Age:

In your issue of Feb. 14, referring to variable throw lever clutch, by A. J. Martin, we notice that he states, in his example of a 4-in. throw crank, that if a motor is producing, say, 2-h.p., and you drop the crank to ½ in. throw, it is evident that the power is increased to 16-h.p.

We are sorry to see Mr. Martin make an assertion of this kind, as we have yet to see a mechanical device that will give in return as many horse-power as is put into it. Should Mr. Martin require 1 lb. of fuel per horse-power hour to run his engine on, and then throw in his mechanical device and reduce the quantity of fuel from 1 lb. per horse-power to ⅛ lb. per horse-power, why not start out with his 2-h.p. engine and produce his power by cranks, thereby reducing the cost per horse-power at once to ⅛ lb. of fuel.

We know what he means, but he either has not said it right, or it is a typographical error. What he does actually get is not 16-h.p. He increases his leverage eight times, and, if he figures his load and the speed at which he moves, he will find he has 2-h.p. only at the end of his increase of leverage, minus the friction loss.

Hoping that assertions of this kind will not too often occur, we are, yours respectfully,

GEO. W. WALTENBAUGH.

Exact Data Are Scarce.

Springfield, O., Feb. 19.

Editor Horseless Age:

What seems to be neglected in the columns of your publication is the best and most practical method for the construction of certain parts of motors and other devices pertaining to the automobile.

The writer would like to inquire the best method of constructing the crank shaft bearing of a motor where the crank is inclosed and is running in oil.

The principal difficulty encountered is in the adjustment of said bearings and the taking up of wear without allowing the escapement of the oil as it is splashed about the crank shaft.

Respectfully,

W. A. WARSAW.

A Correction Accepted.

Reading, Pa., Feb. 5.

Editor Horseless Age:

I thank Mr. Stoddard for calling my attention to the slip in my article on vaporizers. What I meant to say was that the specific gravity of the saturated mixture—not that of the vapor alone—might vary between the values stated. As the density is an approximate measure of the richness, it will be seen that this makes sense of an otherwise meaningless passage.

HERBERT L. TOWLE.

De Dion Tricycle Gears.

Toronto Junction, Canada, Feb. 16.

Editor Horseless Age:

I would like to know whether any of your readers have tried to lessen the noise made by the gears of the De Dion tricycle. I have tried special gears, but they gave trouble on account of the end thrust, and fiber and rawhide proved unequal to the high speed. If you can give me any help I would be much obliged.

A CONSTANT READER.

A Denial from Mr. Maxim.

891 Sterling Place, Brooklyn,
New York, February 28, 1900.

Editor Horseless Age.

I have noticed in the daily papers advertisements of the Tripler Liquid Air Company, in which I am named as a Consulting Engineer of the Company.

While it is true that I have been consulted by the organizers of the said Company concerning the application of liquid air to the manufacture of explosives, and at their request wrote them a letter on the subject, yet, other than that, I have not been consulted regarding any claims for liquid air which are now being advertised, and for which I am not responsible. I have no connection with the Company.

Very respectfully,
HUDSON MAXIM.

The Horse-Power of Motors.

Attention has been called to the fact that the horse-power ratings of motors, such as are used for motor vehicle service, are not at all times reliable; that they are often overrated, and that a standard system of rating would be desirable, which would convey a more comprehensive idea of the capacity of the motor and form a basis for comparison.

It is no doubt true that the horse-powers of many of the motors in use are rated, not by how much work they are capable of doing, but by how much work their promoters think they ought to do. The rated, or, rather, the advertised, power of a motor depends, therefore, to some extent on the designer, as well as on the motor, a sort of personal factor being introduced.

This, however, may not be done with any intention of misrepresenting the capacity of the machine, but purely through ignorance of the actual or possible horse-power.

Suppose a motor to be designed by a person with sufficient knowledge of the principles concerning gasoline engines to design one intelligently. He assumes a given theoretical indicator diagram which he desires to represent the action of the gases in the cylinder, and which in combination with a given area of cylinder, length of stroke and number of explosions per minute will give him a desired horse-power. If all things should act precisely as he has intended, the motor should indicate that horse-power.

Taking for granted that the proportions of clearance, area of piston, length of stroke and valve mechanism are correct, there are many reasons why the motor in service will not exert this desired horse-power, some of which reasons may be stated as follows:

It is more or less difficult (depending on the size and type of the motor) to obtain the desired explosive mixture in the cylinder. It is also true that in most motors the explosive mixture is not determined until the motor is built, when it is adjusted by trial. Consequently, the mean pressure in the cylinder cannot be easily ascertained, and may differ materially from that intended.

The motor may include so much mechanism in its construction, due to attempts at producing a balanced machine, that the extra bearing surfaces introduced will increase the friction and consequently decrease the mechanical efficiency to such an extent that, although the engine may give the required power in the cylinder, it will not be available for work at the motor shaft.

The foregoing implies, therefore, two horse-powers for the same motor—the indicated horse-power, or the power developed in the engine cylinder, and the available horse-power, or the horse-power at the engine shaft. This latter, known as the brake horse-power (b.h.p.), is never as great as the indicated horse-power (i h.p.). the ratio $\frac{\text{b.h.p.}}{\text{i.h.p.}}$ being known as the mechanical efficiency of the machine, and will vary between wide limits, depending on the design and construction. It might be, in some motors of particularly good design and workmanship, as high as .90; but in most motors it would be very much lower than this—perhaps from .65 to .80. This fact, being not well understood by all interested in motors, will account in a measure for the overrating of capacities.

At this point might be mentioned another consideration not generally stated, but which should be of equal importance with the motor capacity. That is the gasoline consumption, or the expense of operation. Two motors of the same brake horse-power, but differing in design or workmanship, may have very different fuel consumptions, and it is obvious that the motor requiring the least gasoline per brake horse-power, other things being equal, would be the most desirable machine.

Now, if for a motor of given weight, size and cost, the desirability depends primarily on the horse-power capacity and fuel consumption, we should rate our machine accordingly. With a motor rated as so much brake horse-power, with a consumption of so many pints of gasoline per brake horse-power per hour, there could be no mistake as to the results which would be obtained with any motor.

A standard rating for motors, however, infers a standard method of arriving at this rating; otherwise there would be the same objection as before—a misunderstanding as to what is meant.

For those persons acquainted with these terms and with the methods of obtaining the quantities necessary for their computation, it is clear that the brake horse-power means the same, no matter how it is ascertained; but for the benefit of those not so versed, we will discuss a method for testing small motors and of deriving the above mentioned quantities.

Fig. 1 shows a vertical motor set up for testing, with the object of ascertaining the brake horse-power and the gasoline per brake horse-power per hour.

The gasoline connections are made up in about the same way that they would be in a carriage, except that in place of the carriage tank there is provided a graduated measuring tank, A, which will hold sufficient fuel for a run of three or four hours, with a maximum load. A convenient arrangement is to have a tank with a glass gauge on outside connected to the interior of the tank at the bottom. This may be graduated to read in pints by filling the tank with carefully measured quantities and marking on a paper scale back of the glass tube the exact height of the fluid in the tube, as shown in detail in Fig. 2.

If the electric spark is used for ignition, the wires have only to be connected up as usual; but if the hot tube is used there should be a second tank, from which the gasoline used for ignition may be drawn and measured. In this way the gasoline consumed in the cylinder may be measured separate from that used for ignition.

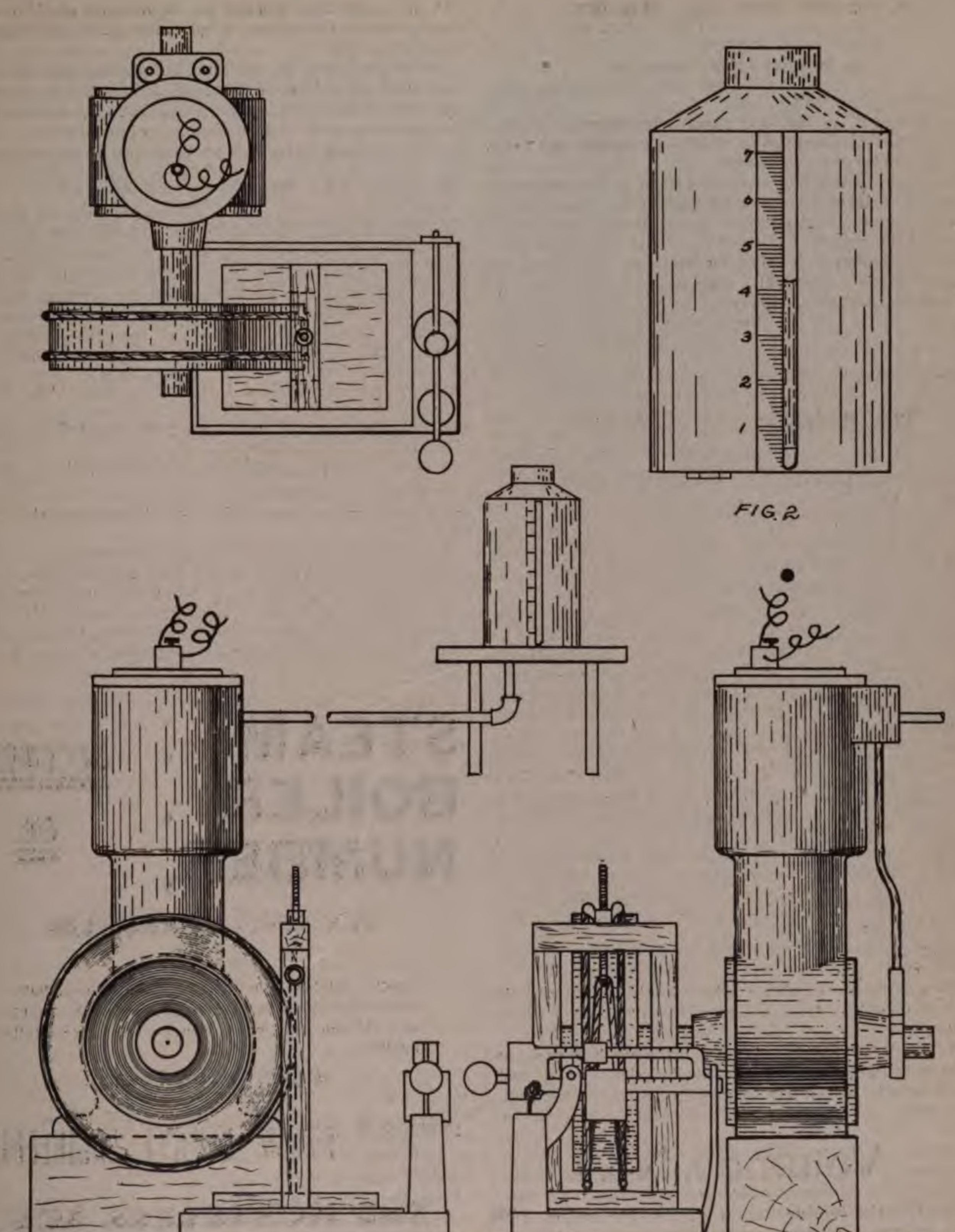


FIG. 2

FIG 1

THE HORSE-POWER OF MOTORS, BY E. C. OLIVER.

Of the many forms of brakes which may be used for absorbing and measuring the power of the motor, the one shown in the sketch (Fig. 1) is probably as suitable for the purpose as any. It is simple, easily adjusted, and the pull on the brake can be measured very accurately. This brake consists of a yoke of wood fastened to a base, which rests on the platform of a scale; a small rope is doubled and carried one full turn around the fly wheel (which should be turned true on the outside), the free ends fastened to staples in the base and the top end fastened to an eye bolt which passes through the top bar of the yoke. This eye bolt should be threaded a considerable portion of its length and provided with a ring nut on top for adjustment.

A speed counter should be provided for determining the rate of rotation of the shaft, or revolutions per minute.

With these arrangements completed, the motor should be started and allowed to run with load for some minutes, to allow it to assume uniform conditions. At a noted time a reading should be taken of the level of the gasoline in the tank, and this time taken as the beginning of the test. Constant attention should be given the brake and scale to keep the load constant throughout the test, and readings of the revolutions per minute taken at regular intervals, five minutes being about the proper length of time between readings for a test of this kind.

The test should be continued for three or four hours, as this will be sufficient to make negligible any error that there may be in reading the level of the gasoline at the beginning and end of the test. The final reading of the gasoline should be taken with the motor running.

We now have the following data: Amount of gasoline used, revolutions per minute at each consecutive five minutes, and scale reading of the brake load. We may reduce these to gasoline used per hour, average revolutions per minute, brake horse-power, and gasoline per brake horse-power per hour.

The brake horse-power is derived as follows: Measure, in feet, the distance from the center of the shaft to the center of the brake rope on rim of fly wheel. This we will call the length of brake arm and designate by L. The net reading of the scale we will designate by W. Now, the number of foot-pounds of work done by the motor per revolution = W multiplied by the circumference of the brake arm circle, or $W \times 2\pi L$, and the foot-pounds of work done per minute is $W \times 2\pi L$ multiplied by the number of revolutions per minute, or $W \times 2\pi L \times N$ per minute. Since 1-h.p. is 33,000 foot-pounds per minute, the power of the motor will be

$$\frac{W.\ 2\pi L.\ N.}{33000} \text{ or } .0001904 \text{ W L N.}$$

By dividing the gasoline per hour by the horse-power thus obtained, we have the fuel consumption per horse-power per hour.

With this information at hand we may state the capacity and economy of our machine with a certainty that it will be again realized under similar conditions.

Other information may be obtained from the test by counting the number of explosions per minute and total number during the test. This should be done by attaching some form of lever counter to the valve mechanism which controls the admission of gasoline, so that every admission and explosion may be registered. This applies, however, only to those motors which have the hit and miss type of governor.

If the total amount of gasoline be divided by the total number of explosions, the amount of gasoline per explosion may be ascertained.

The mechanical efficiency of the machine may be approximated as follows: Count the number of explosions per minute under full load. Call this N. Now, throw off the brake and count the number of explosions running light—n. Subtract the latter from the former, and the resulting number will be the required explosions per minute for the brake horse-power. The friction horse-power, or the power required to run the motor (F.H.P.), may be found by proportion (N—n) : n : : B.H.P. : F.H.P., or $\text{F.H.P.} = \frac{\text{n. B.H P.}}{\text{N–n.}}$ The brake horse-power plus the friction horse-power equals the indicated horse-power, and the mechanical efficiency equals $\frac{\text{B.H.P}}{\text{I.H.P.}}$ or $\frac{\text{B.H.P}}{\text{BHP} + \text{F.H.P.}}$ From the indicated horse-power the mean effective pressure in the cylinder may be computed.

This, however, as has been said, is only approximate, as the friction horse-power will be slightly greater under load than when running light, and the explosions running light will probably be more intense than when loaded, both of which will tend to raise the apparent mechanical efficiency of the motor.

MINOR MENTION.

Eastern emissaries are endeavoring to organize the Columbus (O.) Autocar & Delivery Co., capital $100,000.

The Wire Goods Co., Worcester, Mass., report a good demand for their 3-16 wire spokes.

The Stanley Mfg. Co., Boston and Lawrence, Mass., will soon open a New York office.

Milne & Killam, 10 Crescent St., Everett, Mass., have issued a catalogue of their engines, boilers and burners for motor vehicles.

Howell & Meehan, 24 Kingston St., Boston, Mass., have secured the sole selling agency for the steam vehicles of the New England Motor Carriage Co., Waltham, Mass.

Arthur J. Eddy, owner of three automobiles of different motive powers, was the first person licensed to operate an automobile in Chicago.

The Denison Electrical Engineering Co., New Haven, Conn., are building several omnibuses, to be propelled by their three-cylinder, vertical, 12-h.p. gasoline motors.

The Electrical Development Co. was recently incorporated in Delaware to deal in motor vehicles. The capital stock is $200,000.

The Laconia Car Co., Laconia, N. H., is contemplating an increase in its plant for the purpose of manufacturing motor vehicles.

Joseph J. Mandery, 353 East Main St., Rochester, N. Y., has secured the agency of the Locomobile for nine counties in that section of New York.

The Sandusky (O.) Automobile Mfg. Co. has purchased the entire plant, stock, drawings, etc., of the Ohio Gas Engine Co., Bucyrus, O., and transferred them to Sandusky.

The employees of the Woods Motor Vehicle Co., Chicago, Ill., have gone out on strike because the company refused to sign the new scale of machinists' wages, to go into effect March 1.

Thomas A. Whelan and Reuben C. Foster have been appointed receivers for the Crouch Automobile Mfg. & Transportation Co., Baltimore, Md., on the petition of Wallace C. Stebbins and others.

A new Winton catalogue is out. An interesting feature is the numerous testimonials from satisfied customers, who have found pleasure in the use of these substantial and powerful machines.

The Oyler Mfg. Co. is a new Minneapolis, Minn., corporation, organized to manufacture automobiles. Capital, $50,000. Incorporators: John T. Oyler and Charles H. Speck, of Minneapolis, and William F. Fuller, of Warren, Minn.

It is reported that the Electric Vehicle Co. and the Anglo-American Rapid Vehicle Co. are to combine. If this is done high water mark will be obscured and we may expect a rise in the Great Lakes.

The Lake Shore Engine Works, Marquette, Mich., are manufacturing a line of marine motors of the two-cycle type, one, two or three cylinders, and developing from ½-h.p. to 24-h.p. These motors are called the "Superior."

The Winslow Motor Carriage Co., capital stock $100,000, is a new corporation organized under Delaware laws to do business in Philadelphia. The promoter is Arthur S. Winslow, formerly connected with the National Motor Carriage Co.

The National Cement & Rubber Mfg. Co., Toledo, O., are making an extra heavy liquid solution, called Liquid Auto Tire Cement, which is specially adapted for cementing motor vehicle tires to wood or metal rims. They also manufacture enameling ovens, braziers, vulcanizers, gasoline torches, etc.

The Ashton Valve Co., 271 Franklin St., Boston, Mass., well known for 25 years as manufacturers of reliable high pressure steam specialties, have turned their attention to the motor vehicle, and are prepared to furnish pop safety valves, cylinder relief valves, steam gauges, automatic water gauges and gauge cocks for both light and heavy vehicles.

The National Automobile & Electric Co. has been incorporated at Indianapolis, Ind., with $250,000 capital, by L. S. Dow, Albert E. Metzger, Arthur C. Newby, Philip Goetz, Charles E. Test, Robert Martindale and H. T. Hearsey. L. S. Dow will be president and general manager. Large factory buildings will be erected and carriages will be put on the market by midsummer.

Metropolitan Items.

The Perret Storage Battery Co. have removed their offices to No. 21 State St.

The Auto-Electric Air Pump Co. have in preparation an interesting illustrated catalogue of their tire inflating pumps.

The Arthur Co., of 188 and 190 Front St., will soon publish a descriptive circular of their motor vehicle gears.

James H. Lancaster, the well-known manufacturer of acetylene gas plants, is building a gasoline vehicle.

Air cushions specially made for automobiles will be on exhibition at the Sportsman's Show next month by the Mechanical Fabric Co., Providence, R. I.

The Blaurock Carriage Co., Fiftieth St. and Broadway, expect to exhibit a line of horseless vehicles at their salesrooms during the summer.

The New York Electric Vehicle Transportation Co. have moved to 541 Fifth Ave., under the Hotel Lorraine. James Joyce, Jr., is in charge.

The Anglo-American Rapid Vehicle Co. have opened their salesrooms at the Victoria Hotel, Fifth Ave. and Twenty-Sixth St., and have a number of their carriages on exhibition.

The Automobile Forecarriage Co. have recently changed a number of the delivery wagons belonging to a prominent New York express company into automobiles by the substitution of their forecarriages.

Elaborate offices and salesroom have been opened by the American Electric Vehicle Co. on West Thirty-eighth St. Their name is emblazoned in electric lights on the roof of their building. The offices are on the second floor.

A salesroom for automobiles has been opened at 944 Eighth Ave. by the Graphic Cycle Co.

A new style of controller for electric vehicles will shortly be put on the market by the Niles Tool Works Co., 136 Liberty St.

George R. Bidwell, Collector of the Port of New York, a recently elected member of the Automobile Club, has been appointed on the Good Roads Committee.

A. L. Bogart, whose automatic igniter for steam vehicle burners was recently described in our columns, has so simplified the apparatus that the spark coil is dispensed with, diminishing the cost and saving space in the vehicle.

The Locomobile Co. of America have opened a show room in the corridor of 71 Broadway, at the entrance to the Rector St. station of the elevated. They have two of their vehicles on exhibition.

Undoubtedly one of the largest and most thoroughly equipped stations for Automobiles and Horseless Vehicles recently opened, is the Manhattan, at 211, 213, 215 West 32d Street. Fireproof storage is guaranteed, together with competent supervision. Batteries are charged, and Auto's washed and cleaned carefully. The entrance for the Auto's is at 211 West 32d Street. Asphalt pavement extends from Fifth to Eighth Avenues, directly into the station. The floor space is 75 x 250 feet.

A Motor Mail Carrier.

The accompanying sketch shows a motor mail collection cart designed by Lawrence Nash, a letter carrier of Detroit, Mich., who has been studying the motor problem with special reference to the postal service for some time. His chief purpose has been to construct a vehicle easy to mount and dismount, powerful and simple in operation, and yet pleasing to the eye. The vehicle is propelled by a 5-h.p. gasoline motor of special design, giving speeds of from 3 to 12 miles an hour, which are considered sufficient for the purpose. The tread is 56 in. and the wheel base 60 in. One lever starts, stops and reverses. Speed is controlled by a heel button. Fuel and water for a 100-mile run can be carried. As all the mechanism is placed under the seat, the center of gravity is low. The estimated weight is 600 lbs.

Inter Urban Motor Traffic.

The City Council of Urbana, Ill., has granted a 20-year franchise to the Twin City Automobile Transfer Co., recently organized in Champaign, with a capital stock of $75,000. An application has been made for incorporation under the laws of the State, and the City Council of Champaign will grant a franchise for the same length of time as the Council of Urbana.

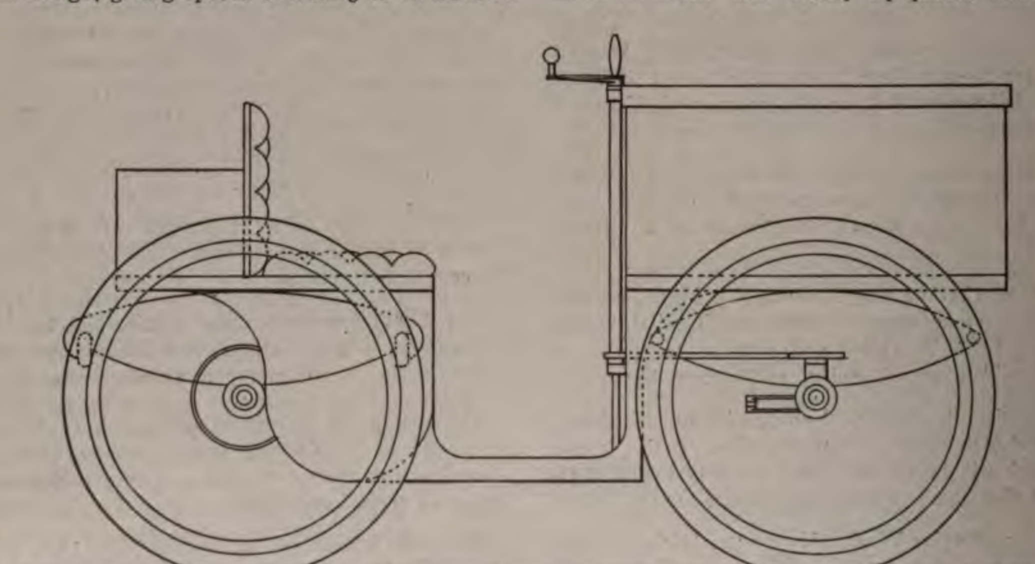
The principal promoters of the scheme, which is intended to give rapid and cheap transportation to all parts of the Twin Cities and the University grounds, are Attorney C. R. Iungerich, M. L. Williams and W. H. Zorger.

The cars with which the system is to be equipped are said to have been ordered in the East. They are to be 26 ft. long, fitted with electric gong and headlight, rubber tires, and will be heated by steam and capable of carrying 20 passengers. They will weigh about 2,000 lbs.

Lighter and smaller carriages will be used to run to points out of the city, connecting with neighboring towns and resorts, so says a Western newspaper.

An Electric Ambulance.

F. R. Wood & Sons, well-known carriage builders of New York city, who have made a specialty of motor vehicle work for several years, have recently constructed for St. Vincent's Hospital the first electric ambulance put in service in this country. It weighs 4,000 lbs. and is geared to a speed of 9 miles an hour. The battery equipment consists of 44 cells



DESIGN OF MAIL CARRIER. LAWRENCE NASH.

grouped in four sets. By means of plate glass windows in the front and sides and glass doors at the rear the vehicle can be entirely inclosed. The windows are of the disappearing type and the doors are removable, so that it will be equally serviceable both summer and winter. Solid rubber tires are employed.

Mechanical Horses.

We illustrate below an ordinary express wagon converted into a motor wagon by the substitution of the Kuflstein-Vollmer gasoline forecarriage for the front truck. The Automobile Forecarriage Co., who are introducing these mechanical horses here, state that they intend to convert many of the express wagons now used in New York in this manner.

Automobile Oil Cups.

A motor carriage is a machine that needs plenty of oil to keep its parts in good working order. Hence, oil cups are a daily necessity to the motor vehicle manufacturer. Oil cups for this purpose should be positively dust proof, self-closing, neat in appearance and easily attached to any machine or

"4-C." "4-B" "4-D."

place where they may be used. Some are threaded and others are tapered about .003 in. to insure a good drive fit. The Bowen Mfg. Co., Auburn, N. Y., make a specialty of these

CONVERTED EXPRESS WAGON.

cups, made in different sizes, to suit customers' wishes. Style "C" is specially adaptable to automobiles, as it sets down low out of the way, and the tube under the thread carries the oil to the bearings.

The Bowen Mfg. Co. also make felt washers of different diameters and thicknesses for automobiles.

Dry Graphite Cylinder Lubrication.

The Joseph Dixon Crucible Co., Jersey City, N. J., state that graphite seems destined to solve a knotty problem in gasoline or gas engine cylinder lubrication. From experience gained by them during the past year they believe that much depends on the kind of insulation employed as to whether the graphite is likely to short circuit the electric connection or not. If porcelain insulation is used the force of the explosion keeps blowing the graphite off of it, but when asbestos insulation is used it becomes saturated with graphite and oil and sometimes short circuits the connections. Sibley & Newton, 227 Bleecker St., New York, manufacturers of the "Rotamotor," testify to the merit of dry graphite lubrication, without the mixture of oil. They say:

We discarded the mixture of oil and graphite, because it clogged the insulator. With cylinders finished as accurately as ours, we believe we have detected some new and valuable results through the use of Dixon's dry graphite.

Not only is perfect lubrication established, but the presence of graphite greatly reduces the resistance between the sparking points.

The reliability of the jump spark is such an important feature in the working of the hydrocarbon engine that any suggestion to improve this point has only to be mentioned to receive general adoption.

We also find that the use of dry graphite in the cylinders reduces the characteristic odors to an inoffensive minimum.

Universal Genius from the Backwoods.

The following is a fair example of a class of literature that the motor movement has called out:

I have invented a machine that will drive any machine from a tenncent toy to a train of cars, or the largest ocean vesail that eve sailed with out the aid of steam or lectrissity or any other power atached it done by waits and leaver I yose a balansed leaver so you can run the largest machine on earth with your little finger it will run anything great or small moving or stationary it will run wagons on the road or cars on the track as you are fixed to doo anything I would like for yo to take a shair and doo the manufatering for I have no money to put through the patent office and get before the people it will aply to all kind of youse that any other power will thare is no power that will excell it in power or spead theare neave was a power that will sell qick on the marke it is worth millions the cost of manufactering is nothing to what any other powe costs yo can throw 20 inches of with one finger now as you have for the mcinery and tools to do any kind of work I think that yo will bee the very one to take hould of it I am so oald and paralised that I cannot doo anything and I will give you a good show for thair is enoug in it for five huded so thair is no yuse of one man making a hog of himself I would like to put up a lite road wagon that will run without steam I will sen you a ruff drawing of my power and if you have any iydea takieing thold of it please inform me at once and I will come down and help yo through with it as it is to good to let dy with out giving it a trial I cannot dooit for the want of money if it is posable for yo to doo so from yours respectfully.

OUR FOREIGN EXCHANGES.

Two German Gasoline Vehicles.

Just as in France, the tendency in automobile circles in Germany appears to be in the direction of neat two-seated carriages at a reasonable price. The accompanying illustration (Fig. 1) depicts the elegant vehicle of this kind recently introduced by the Gesellschaft für Automobilwagenbau (system Loutzky), of 49 Französische, Berlin, W. The motive power is a two-cylinder vertical motor of 3½-h.p., of which two sectional views are given in Figs. 2 and 3. The engine is fitted with electrical ignition and water jacketed cylinders. An interesting feature of the motor, which runs at a speed of from 1,200 to 1,500 revolutions per minute, is that the inlet valves are mechanically operated. For the purpose of a sure ignition, the inventor believes a straight, narrow igniting must be employed. For this object the exhaust valve is arranged on the narrow igniting passing in front of the suction valve, so that during the compression stroke of the motor only a pure mixture exists at the outermost end of the igniting passage over the valve. It will also be noticed from Figs. 2 and 3 that the valve rods lie in one plane with the vertical axis. In order to regulate these valves the controlling levers connected thereto also lie in a similar vertical plane, and are operated by a common cam. The cam engaging points of both valve levers are displaced in such a way on a centric angle of 90 degs. that the common cam serves for controlling both inlet and exhaust valves. In the case of motors provided with exhaust silencers, Herr Loutzky has found that a back pressure is exerted on the exhaust by the silencer. To overcome this back pressure he has so arranged his exhaust valve that it is opened a little before the completion of the expansion period, allowing a portion of the consumed gases to escape under pressure, with the object of thus quickening the movement of the exhaust valve. The valve controlling cam is provided with a step, which operates the lever of the exhaust valve, while the shorter projection of the operating lever of the inlet valve is not operated by this step.

The engine is located in the rear of the frame and is geared direct by spur wheels to the rear axle. Two forward speeds, as also a reverse motion, are provided, the variable speed

LIGHT GERMAN GASOLINE CARRIAGE.

gear being controlled by a single lever on the steering pillar connected up to friction clutches. The gasoline tank is located under the seat and has a capacity of 30 liters. The water circulation is maintained by means of a small pump, a cooling coil being also provided. Steering is controlled by a hand wheel, while a device is also provided by means of which the motor can be put in operation from the conductor's seat. Ample brake power is provided, while a foot pedal opens the compression tap at starting. The wheels are of the cycle type, shod with pneumatic tires. The weight of the carriage complete is given at 550 lbs.

GERMAN PARCELS CARRIER.

Another very interesting vehicle constructed by Herr Loutzky's company is the motor parcels delivery illustrated here, several of which are now being tried by the German postal authorities. The frame of the vehicle is built up of steel tubing. The parcels box, or chest, has a capacity of ¾ cubic meter, while accommodation is provided at the rear for two persons. The parcels box is provided on one side with double outwardly opening doors; there is a shelf inside, while the top is railed. The speed of the motor ranges from 1,500 to 1,800 revolutions per minute, the inlet valve being operated automatically. The motor is geared direct to the rear axle by means of a two-speed gear. A friction clutch is also provided, by means of which the motor can be instantly cut out from the transmission gear. The motor is arranged to be started from the driver's seat, while the steering is controlled by a horizontal hand wheel. The gasoline tank, which has a capacity of 30 liters, is located under the rider's seat. The water circulation is maintained by means of a small pump, the water tank and cooling coil being located in the fore part of the frame. The vehicle is 11 ft. long by 4 ft. wide, and weighs about 780 lbs. It is able to carry a load of similar weight, and can attain a maximum speed of 15 miles an hour.

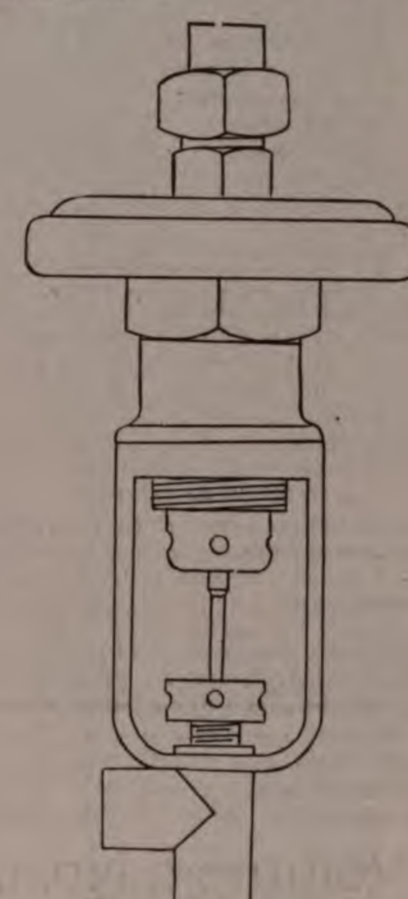
Nungesser Sparking Batteries.

The Nungesser Portable Rubber Cell closed circuit batteries are now coming into favor among gasoline vehicle manufacturers. On account of their long life and strength, no generator is said to be required. They will operate either primary or Ruhmkorff coils, producing either a "contact" or a "jump" spark, and, according to the experience of the

Winton Motor Carriage Co., will last on the average about 5,000 miles. No oil is required on the surface of the solution, and the cell having a screw top, no air can enter or liquid escape after the top is screwed down. Oil is said to be a fertile source of degeneration in batteries of this class. The special agent for these batteries is L. H. Allen, 2427 Michigan Ave., Chicago, Ill., whose motto is "From Factory to Consumer."

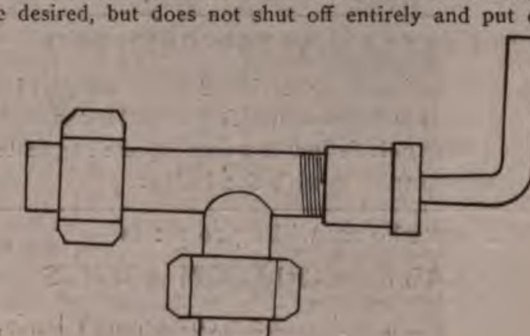
Locke Steam Vehicle Specialties.

It is an encouraging sign for the new industry when concerns of reputation and experience like the Locke Regulator Co., Salem, Mass., join the procession. The Locke Co. have been making steam specialties for more than 30 years and are therefore well qualified to supply many of the fittings required for steam vehicles. They have designed especially for this service a line of gasoline and water regulators, pin valves, water relief valves, etc.



GASOLINE REGULATOR.

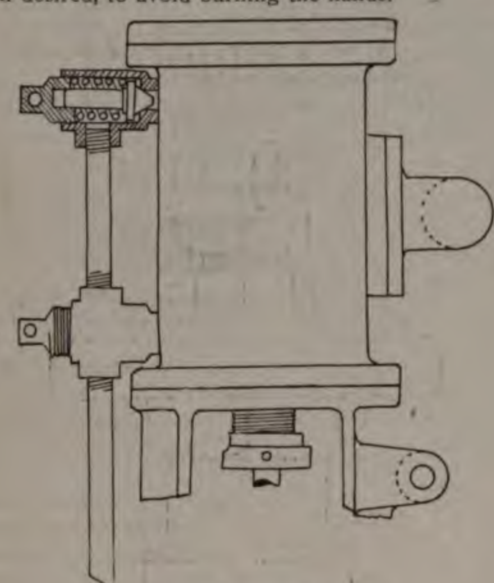
The gasoline regulator acts on the gas after it has passed through the hot coils, and can be controlled automatically so as to shut down the flow when the steam reaches any pressure desired, but does not shut off entirely and put out the



PIN VALVE.

fire. It contains the same metal diaphragm used for many years with success in the company's Beats All reducing valves and pump governors.

The pin valves, made square or round, have ground, seated unions, finished on the end of valve, saving joints and soldering. Wire hand wheels are furnished instead of crank arms, if desired, to avoid burning the hands.



WATER RELIEF VALVES.

The water regulator, to keep a uniform level in the boiler, is operated by a copper float in a composition chamber, combined with a balance valve, such as is used on the Locke Damper Regulator.

In the water relief valves the upper valve lifts like a safety valve and blows directly through the lower one, and the lower one lifts when there is an accumulation of water in the lower end of the cylinder, preventing straining and pounding.

The Locke Co. would be glad to correspond with owners of steam carriages in regard to the regulation of the water and gasoline supply.

Low Water Alarm.

Automatic Water Regulators are much sought after by manufacturers of steam vehicles, and quite a number of such devices are being offered for this purpose. Among them is the Low Water Indicator made by the Kitts Mfg. Co., Oswego, N. Y. The mechanical construction is very simple. The compound levers are attached to the cover of the column, and to the end of the long lever is attached the whistle valve. To the short lever is connected the rod which extends nearly to the bottom of the column carrying the gravity weight. There is a small weight on the long lever which slightly overbalances the gravity weight when submerged, thereby closing the valve to the whistle. When the water is low in the boiler it also falls in the column, and as it leaves the gravity weight, the same begins to pull down on the compound levers, the valve opens, and the whistle blows the alarm.

It can be tested at any time by simply opening the blow-off valve, which tries the indicator, clears out the water glass, and proves that everything is in working order.

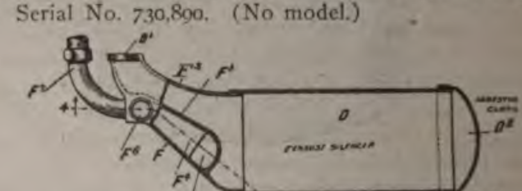
By the use of this indicator it is said a low gauge of water may be safely carried, giving greater steam space and dry steam, thereby requiring less fuel. It is easy of access, the mechanical parts being attached to the cover of the water column. All the internal parts may be taken out by unscrewing the bolts which fasten down the cover; and the whole may be replaced in a few moments.

MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

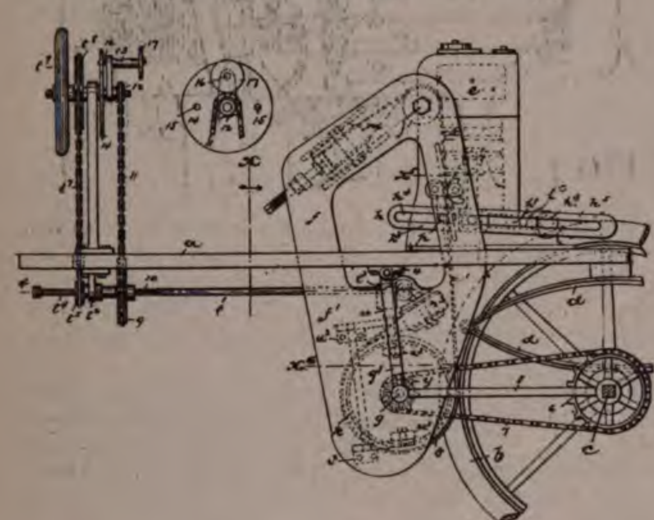
No. 644,027.—Hydrocarbon Vaporizer for Explosive Engines.—William Baines, London, England. Filed Sept. 18, 1899. Serial No. 730,890. (No model.)



Claim.—1. In a device of the character described, the combination with the casing of an exhaust silencer, having an inlet at one end for admission of exhaust gases and an outlet at the opposite end for the said gases; of a partition, F' within the casing; a second partition, F^3, forming the chambers F^2 F^4, communicating with each other at one end, the chamber F^2 communicating with an inlet for the explosive charge, and the chamber F^3 communicating with an outlet for the said charge.

No. 643,627—Transmitting Device for Horseless Carriages.—John C. Bleveney, Newark, N. J. Filed May 10, 1899. Serial No. 716,212. (No model.)

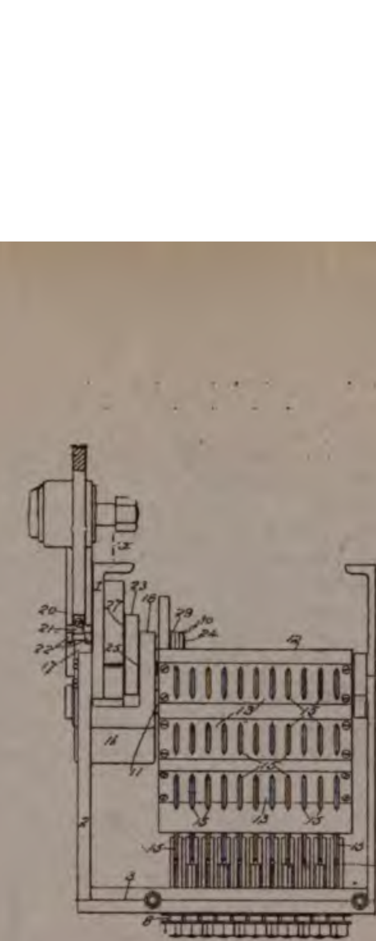
Claim.—4. The combination with a frame having a pair of driving pulleys disposed side by side in said frame, of an endless belt, arranged in said frame, and over said pulleys and moving in opposite directions on said pulleys to effect an opposite rotation of said pulleys, and a clutch arranged in connection with a sprocket wheel for driving the wheels of the vehicle, the said clutch being adapted to be brought into clutching relation to one or the other of said pulleys to effect a reverse movement of the vehicle without changing the direction of movement of the belt, substantially as set forth.



18. In a power transmitting device, the combination with the wheeled and spring supported body a, having motor e, slotted oscillating arm, and swinging frame connected to said body by a pendulous rod, g', rod 8 for holding the swinging frame at a definite distance from the axle of the wheels of said body, pulleys and an endless belt arranged on said frame, an oscillating arm pivoted upon bearings on the vehicle body, a belt clutch operated by said arm, a motor operating said arm, a shifting clutch, a lever operating the same, a threaded and grooved rod, t, operating the shifting clutch and swinging frame, sprocket wheels, t^3 and 9, chains and means for operating said chains.

No. 643,865—Controller for Electric Automobiles.—Chas. G. Burrows, Windsor, Conn., assignor to the Eddy Electric Manufacturing Co., same place. Filed Nov. 15, 1899. Serial No. 737,112. (No model.)

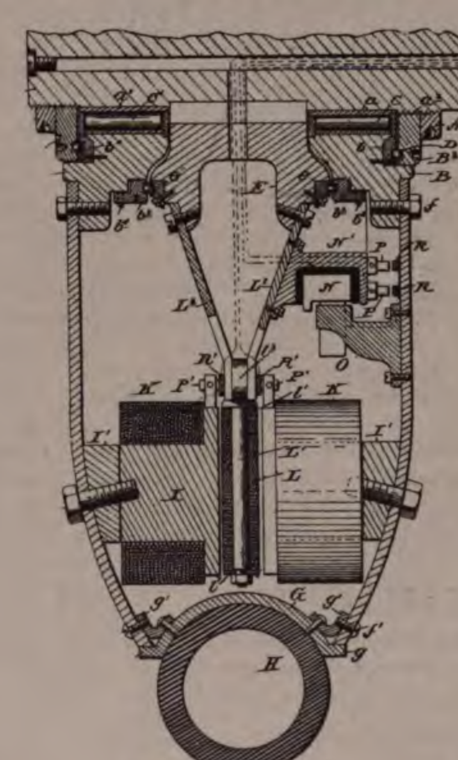
Claim.—1. An electrical controller, consisting of a supporting frame, terminals held by a frame, a drum, contacts carried by the drum in position to be engaged with the terminals, a handle, a plate connected with the drum and oscillated by the handle, springs made tense by the oscillation of the plate, and



lugs adapted to obstruct the forward movement of the plate until a spring has been made tense.

No. 643,854—Electric Motor Wheel.—James T. Whittlesey, Elizabeth, N. J. Filed June 26, 1899. Serial No. 721,955. (No model.)

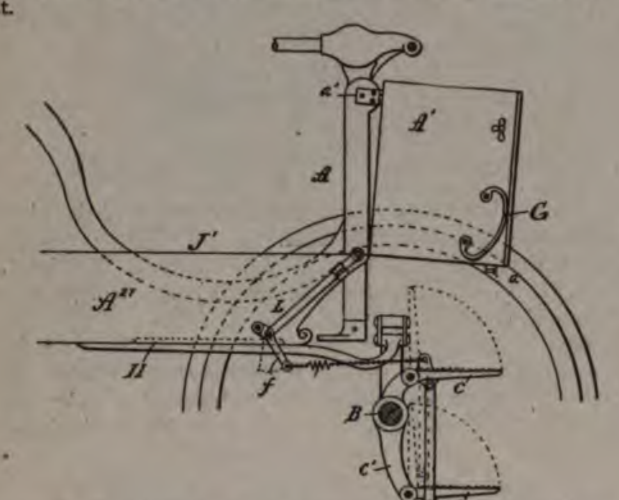
Claim.—2. An electric motor wheel for vehicles, comprising a stationary axle, a stationary electrodynamic element secured to said axle, two hubs, one on each side of said element, webs secured to said hubs, a tire carried on the peripheries of



said webs, moving electrodynamic elements secured to said webs on each side of the stationary element, and means for axially adjusting the hubs in order to maintain the proper alignment of the parts and a predetermined air gap between the stationary and the moving electrodynamic elements.

No. 643,257—Motor Carriage.—Elmer A. Sperry, Cleveland, O. Application filed Sept. 11, 1899.

The drawing shows a sectional diagrammatic view of a portion of the front end of the buggy, showing the split dasher with hinged portion swung out, affording ready access to the carriage by means of the steps, as indicated. Access is facilitated by the grasping handle G, located upon the dasher part. The front axle of the carriage will be understood to be non-swiveling . The spring attachment as now appearing in the drawing is of the usual arrangement where a non-swiveling axle is employed constituting a direct connection from the axle B to the end of the spring yoke located directly above it.



J'' is the floor of the carriage, supplied with the dasher A, with the swinging portion A'. The stationary portion may support the controller. The moving portion is supplied with handles and catch or lock a and hinge a'. The steps c c are hinged on a bracket c', suitably fastened to the non-swiveling axle B. The steps may be thrown up by any suitable arrangement, either manually actuated or automatically, by the closing of the door-shaped dasher part A', by impinging on the link L, provided at the top with roller and hinged at the lower end to a lever f, which is suitably connected to one or both of the steps by any suitable connection, preferably through a resilient medium e.

No. 643,513—Igniter for Explosive Engines.—Fred J. Macey, Ontonagon, Mich. Application filed Aug. 26, 1898.

Fig. 1 is a side elevation and partial section of an engine having the device applied thereto.

The firing device is adapted to be attached to any of the explosive engines ordinarily used, whether using gas or oil.

The object of the invention is to insure bright contacting surfaces upon the contact points or firing pins, so that the spark is always certain.

The engine herein shown has a cylinder, B, mounted upon a frame, A, and the explosive mixture is conducted to the cylinder through a pipe, E, which has two pipes, E' and E², respectively, leading to opposite ends of the cylinder.

The type of engine herein shown is double acting—that is, produces an explosion in each end of the cylinder.

The cylinder is provided with a boss, I, having a suitable guide formed thereon adapted to receive a block, I', and to guide the same in a straight line between the two firing chambers. This block is provided with a hole adapted to receive the bar J. The bar J is provided with longitudinally extend-

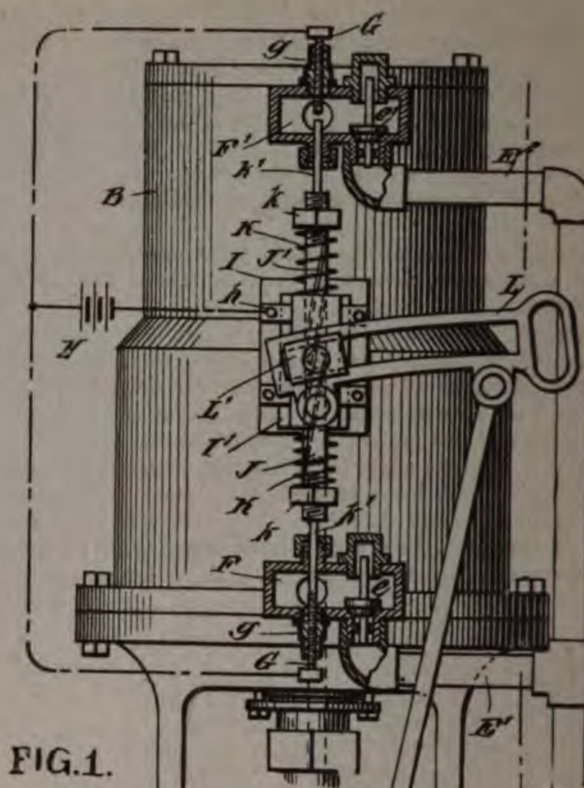


FIG.1.

ing grooves, J', which are given a slight spiral twist, so that if the bar is given movement longitudinally relative to the block I' it will also be given a slight twisting or turning movement, it being of course understood that the block I' is provided with a protection of some sort which will engage the grooves in the bar.

The block I' is reciprocated by means of a link, L, which is provided with the usual block L', said block being mounted upon a pin L², carried by the block I. The link L is reciprocated by means of two eccentrics, D and D', which are mounted upon the engine shaft C and are connected with the links by means of rods d and d'. By shifting the link so as to engage opposite ends thereof with the block L' the time of action of the firing pins may be changed, so that the engine will be reversed to turn in opposite directions.

The bar or rod J is screw threaded at each end and has nuts, k, screwed thereon and acting as adjustable stops for spiral springs, K, which surround the ends of the rod or bar between the nuts and the ends of the block I'. These springs serve to normally hold the rod in a central position relative to the block, but will yield when the end of the rod or the firing pin comes in contact with any fixed object. By this means the firing pin is not rotated until it has contacted with its co-operating firing pin.

The block I' has a little overtravel—that is, travels farther than is necessary to bring the firing pin in actual contact. This slight overtravel thus causes a slight turning movement of the firing pins after their ends have come in contact. This turning movement is sufficient to rub off any dirt which may be deposited upon the ends of the pins or any oxid which may form thereon, and thus constantly maintain a bright surface. As a result of this the spark is produced with absolute certainty whenever the pins come in contact and is of such character as to insure explosions of the gaseous mixture.

No. 643,130—Power Transmitting Device.—Thaddeus W. Heermans, Chicago, Ill. Application filed May 29, 1899.

Fig. 4 is a broken view, in horizontal section, through the power-transmitting devices embodying the principles of my invention. Fig. 5 is a transverse section of the same on the line 5 5, Fig. 4, looking in the direction of the arrows. Fig. 6 is a similar view on the line 6 6, Fig. 4, looking in the direction of the arrows.

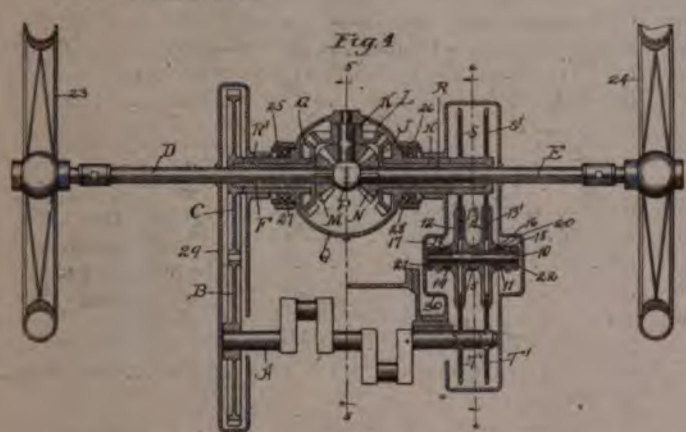


Fig. 4

In the particular form of construction and arrangement illustrated in Fig. 4, to which, however, the invention is not limited or restricted, the shaft to be driven is composed of the independent sections D E. Upon section D of the shaft to be driven is mounted to loosely revolve a sleeve F, and formed with or carried by said sleeve F is a bevel gear G. Upon section E of the driven shaft is similarly sleeved to revolve freely thereon a sleeve H, having formed thereon or carried thereby a similar bevel gear, J, corresponding in size and arrangement to bevel gear G. Suitably arranged with the axis thereof at right angles to the axis of the driven shaft are one or more studs K, carrying a bevel gear L, arranged to intermesh at opposite sides with said bevel gears G J, respectively. Suitably splined to rotate with the section D of the driven shaft is a gear M. Similarly a gear N of similar size and arrangement is splined to rotate with the section E of the driven shaft, and mounted upon stud K to freely rotate thereon a gear, O, arranged to mesh at opposite sides with said gears M and N, respectively.

When rotation is imparted to gears G and J at the same speed, the gear L, intermeshing therewith, will be axially rotated, while the supporting stud K will be held against movement. If, however, the relative speed of rotation of gears J and G be varied—that is, if one of said gears be rotated faster or slower than the other—to compensate for such variation the stud K will be swung or rotated about the axis of the driven shaft—that is, in a plane intersecting such axis at right angles—and in a direction corresponding to the direction of rotation of the gear G or J, which has the greater speed, and the travel of said stud K about the axis of the driven shaft through the engagement of the gear O thereon with the gears M N on the sections D E of the driven shafts effects a rotation of the driven shaft, and the speed of rotation thus imparted to the driven shaft will be equal to one-half the difference in speed of the gears G J. Thus it will be seen that by imparting a greater speed to gear J the driven shaft may be operated in one direction, and by imparting the greater speed to gear G, said driven shaft will be actuated in the opposite direction, and the speed of rotation or movement of the driven

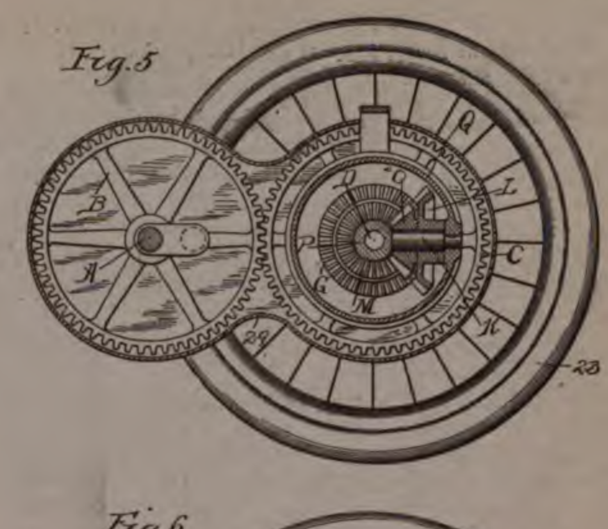


Fig. 5

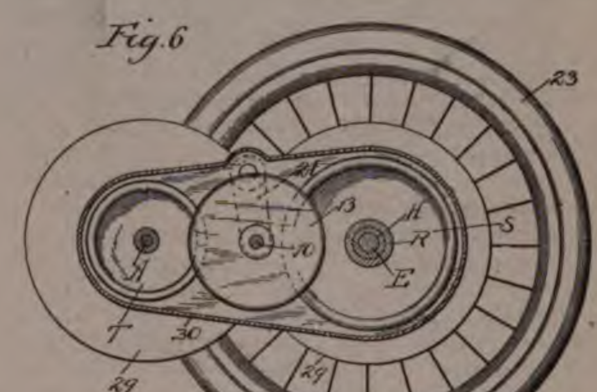


Fig. 6

shaft in either direction will be equal to one-half the difference in relative speeds of said gears G and J. The speed and direction of movement of the driven shaft may be easily regulated by merely varying the speed of relative rotation of the gears G and J or locked against rotation.

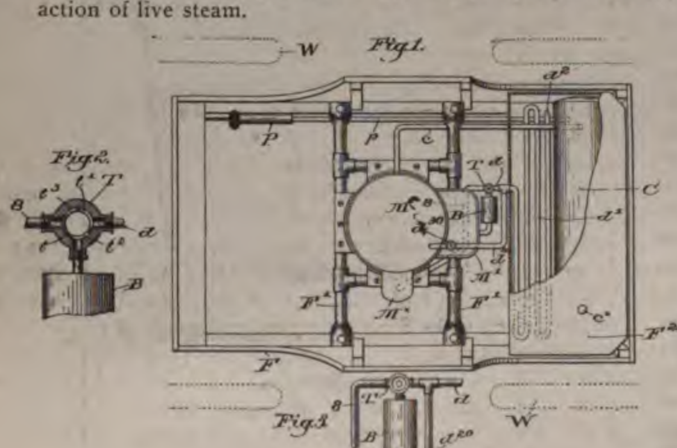
In order to secure the desired variation in speeds of relative rotation of gears G and J, it is only necessary to move pin or stud 10 toward or away from the axis of rotation of the driver disks T T'. Thus a speed reduction is secured between the constantly driven gears T T' and the gears S S', while the relative speeds of gears B and C remain constant. By moving pin or stud 10 laterally with respect to itself, and toward the axis of rotation of the driver disks T T', it will be seen that the contacting peripheries of said driving disks approach nearer and nearer to the center or axis of rotation of the intermediate disks 12 13 12' 13', thus changing the relative speeds of rotation of said driver disks T T' and said intermediate disks by increasing the speed of the intermediate disks. The same movement of stud or pin 10 will cause the peripheral contact surface of gears S S' to approach the periphery of the intermediate disks 12 13 12' 13', thus changing the relative speeds of rotation of the intermediate disks and of the driven disks S S' by increasing the speed of the latter, and hence securing a double increase in speed from the driver disks T T' to the driven disks S S'. Similarly, when pin or stud 10 is moved in the opposite direction, the reverse of the above operation takes place—that is, a double reduction in the relative speed of rotation of gears S S' with respect to the

driver disks T T', is secured. In this manner, by merely moving the pin or support 10 laterally with respect to itself in one direction or the other, the relative speed of rotation of bevel gears G and J may be regulated. The pin or stud 10 may be mounted for movement in the manner indicated in any suitable arrangement. In the form shown, said pin is carried in the end of links 21 22, suitably hinged or mounted in an adjacent part of the casing or framework, thus enabling the intermediate friction disks to be vibrated toward or from the driver and driven gears.

No. 642,943.—February 6, 1900. G. E. Whitney and H. Howard, Boston and Brookline, Mass. Motor vehicle.

Figure 1 is a top or plan view of a sufficient portion of a motor-vehicle and motor, the body of the vehicle being shown and the feed-water tank partially broken out. Fig. 2 is an enlarged detail in section of the three-way cock for controlling the feed-pressure on the liquid fuel. Fig. 3 is an enlarged detail in elevation of a portion of the apparatus shown in Fig. 1, to be referred to. A pipe c, Fig. 1, leads from the receptacle C to the furnace of the motor (not shown in detail), at which the fuel is to be utilized.

As to the operation of the apparatus herein illustrated, the necessary feeding pressure on the fuel is generated by the pump P when it is desired to first start the motor, and thereafter the pressure is generated or maintained by or through heating of the liquid fuel in the receptacle C, the apparatus shown being adapted to heat such receptacle by the rise in temperature of the feed-water due to passage of the motor-exhaust to the bends d'. After the apparatus has been running and has been brought to a standstill there would be no exhaust, and the water in the tank would gradually cool, with a consequent reduction of the feed-pressure on the fuel, and to obviate the use of the pump or other manual pressure-generator to restore such pressure and also maintain the motor in condition for instant use means are provided for maintaining the requisite fuel-feeding pressure by or through the thermal action of the live steam or other medium of the motor. For this purpose connect the steam-space of the boiler M and the pipe d by a branch d^{20}, Figs. 1 and 3, a valve d^{30} in the branch permitting the live steam to pass to the pipe d or cutting off communication between said pipe and the branch, as would be the case when the apparatus is running under ordinary conditions. Obviously the three-way cock T must be so turned to prevent the passage of the live steam from the branch d^{20} out through the stack when feeding pressure is generated by the described action of live steam.



From the foregoing description it will be obvious that the heating of the liquid fuel will tend to vaporize a portion thereof with an attendant creation or generation of pressure, this pressure being utilized to effect the feed of the fuel to the combustion-point, and the pressure increases or decreases with the rise or fall of the temperature to which the main body of the liquid fuel is subjected.

It will be manifest from the foregoing description and the drawings that the heating of the fuel to vaporize a portion sufficient to exert feeding pressure upon the fuel is effected by the application of heat, whatever be the means of so applying the heat, extraneously to the receptacle in which the liquid fuel is contained.

The regulation of the temperature is controlled by the three-way cock T, as by means of the latter the heating medium can be directed wholly to the pipe-bends or partly thereto and partly to the stack of the motor, or it may be shut off altogether from the bends and directed wholly to the stack.

Referring to Fig. 2, the valve t of the three-way cock is provided with ports t' t^2 t^3, so constructed and arranged that the described operation of the cock will effect the desired results.

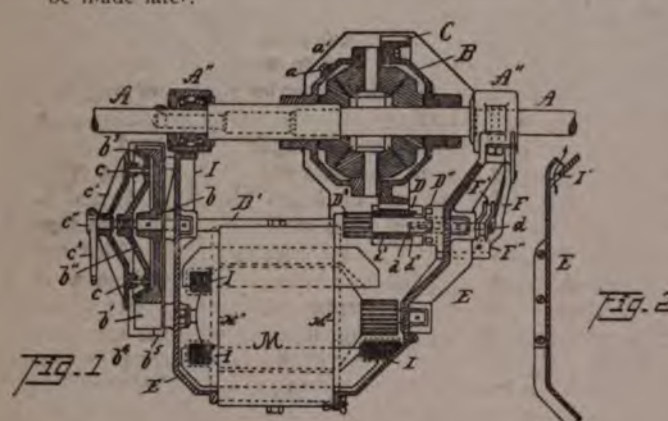
Nine claims. Application filed February 4, 1899.

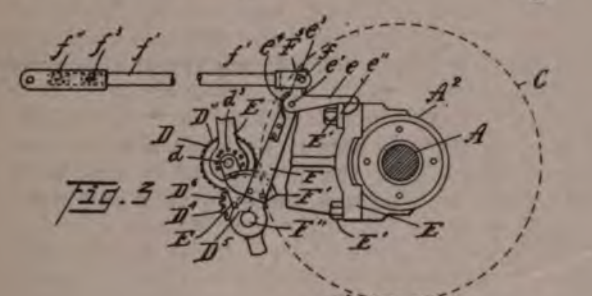
No. 643,258—Motor Vehicle.—Elmer A. Sperry, Cleveland, O. Application filed Aug. 25, 1898.

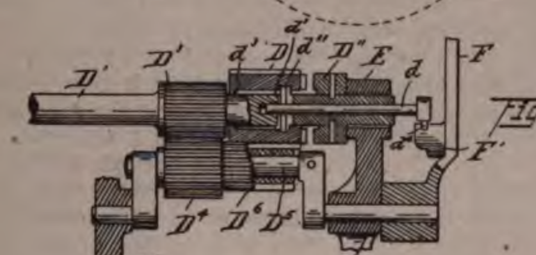
Fig. 1 is a sectional view of motor housing and gearing; Fig. 2, a detail of the housing, showing ventilating passages; Fig. 3, a diagram showing arrangement of the control and lock for the chain gear devices. Fig. 4 is a diagram showing the manipulating devices mounted upon the body connected with and operating parts of the motor gearing. Fig. 5 is supplemental to Figs. 1 and 3, being a section through the intermediate shaft, showing change gear. Fig. 6 is a general view of the supporting truck and axle gear.

Referring now to Fig. 1, let A and A' represent the members, respectively, of a compound axle and a planetary gear arrangement. (Shown in more general view in Fig. 6.) To these shafts are connected, respectively, gears meshing with revolving pinions, all within the oil housing B, furnished with oil plug a. The housing will be seen to consist of the extended web of the gear C, which meshes with the pinion D, all within the inclosing housing a'. The pinion D is mounted upon a shaft, D', which in turn is mounted within the motor housings, which receive support from the journals A'' A'', mounted upon the compound axle. The motor housings E are secured to the circular journal case A'' by two surfaced recesses, preferably parallel with the axis, for holding the parts accurately in line, being clamped by suitable bolts (shown at E' E'.) The shaft D' is preferably supplied with a driving gear b, which meshes with the motor pinion b'. A mechanical clutch or brake is shown, consisting of the disk b'', co-operating with the bevel face within the gear at b^3 and supported by pins c c, which slide in the yoke c', suitably attached to the motor frame or housing E, and serving at its center to hold a rotating screw-threaded shaft c'', rotated by the arm c^3, the screw threads operating to insert and withdraw the conical friction-disk b''. All is preferably surrounded by the housing b^4, separable at b^5. The other end of the shaft D' is socketed for the reception of the rod d, fitted to slide within the socket. The pin d', carried by the rod d extends laterally through an elongated slot (clearly seen), having its ends securely fastened within the internal circular groove

(clearly seen at d″). The rod d in moving backward and forward thus serves to move the pinion D, which is loose upon the shaft D′, out of and into engagement with the clutch D″, rigidly attached to shaft D′. This clutch may be of any suitable construction—such, for instance, as a friction clutch—but I prefer to use the positive jaw clutch shown, so that when the pinion D is slipped to the left, as shown, it is free from the clutch and to the right it is in engagement therewith. The pinion is moved by swinging cam, F′, mounted upon the cam lever F, swinging about a pivot, F″, reference to which will be made later.

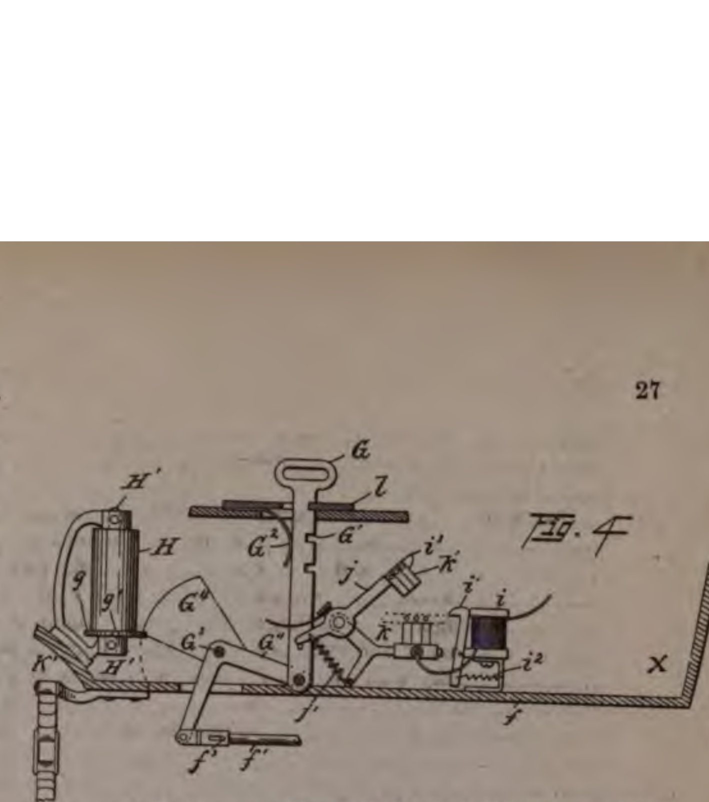






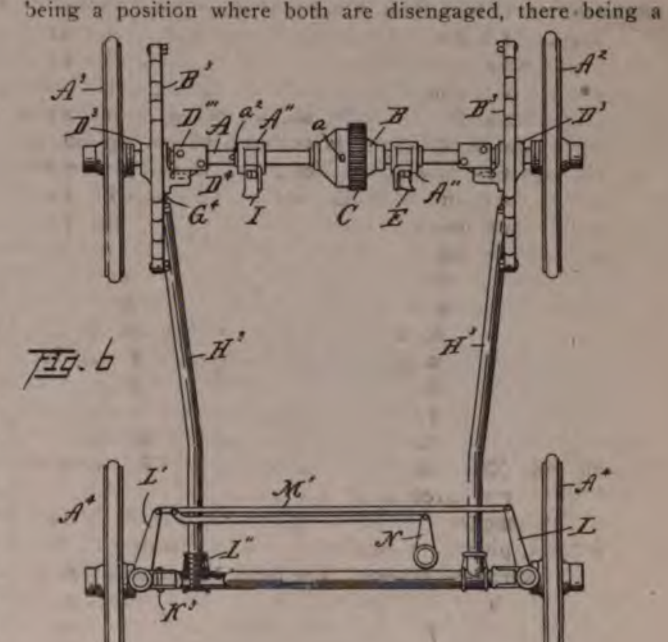
Attention is called to the fact that the pinion D is in a position difficult of lubrication, which is required when same is free upon the shaft. This of necessity is done away with by supplying it with a roller bearing, consisting of a circular roll of needles (indicated at d^3), this style of bearing being also adapted for longitudinal motion upon the shaft necessary in this instance.

The shaft D′ is supplied with the rigidly attached gear D^2. (Clearly seen in Figs. 1, 3 and 5.) This gear is organized to mesh with gear D^4 on a swinging shaft D^5 (clearly seen in Fig 5), being pivoted at F″ in the housing E, and being manipulated by lever F, which attaches to pivot F″ outside the housing. Integral with the gear D^4 and rigidly attached thereto is gear D^6, which, together with D^4, is organized to turn loosely upon the shaft D^5, and which is organized to mesh with master pinion D, mounted loosely upon shaft D′. It



will be seen that by use of lever F the shaft D^5 is swung into and out of mesh or operative engagement with their co-operating gears, and at the same time the master gear D may be made to engage and disengage with its co-operating clutch D″ by means of the cam F′ (clearly seen in Figs. 1, 3 and 5), which is mounted upon lever F′ and moves therewith. This cam engages rod d, provided with an engaging pin d^2, manipulating the rod d longitudinally within the socketed shaft D′ and thus manipulating one member of the co-operating clutches. The arrangement shown in the drawings contemplates the movement of the loose pinion D longitudinally upon the shaft, so that the engaging teeth may be engaged, and this action will be seen to occur at the same time that the throwing in and out of engagement of the gears upon the shaft D^5 takes place, the cam slot being of such contour that the action is not simultaneous with the actual engagement of the gears, but rather occurs dissimultaneously or successively, the clutch being disengaged before the gears are engaged, and vice versa.

In Fig. 5 is seen the lateral pin d′, which serves to connect the rod d with the cam F′. The contour of this cam is plainly seen in the figures and operates to engage the pinion D with its clutch D″ and with its co-operating gear alternately, there being a position where both are disengaged, there being a



region in the center part of the cam where one is disengaged before the other is engaged, where the pinion is entirely free from either.

Owing to the mechanical strains brought to bear upon the lever F and its connected parts a mechanical lock is used (shown by the latch e and its co-operating stationary part e″), having an undercut pawl pivoted upon the lever F at e′, engaging the finger e^2. The finger e^3 is pressed upon at one side by a spring e^4 and upon the other side engages a pin f, connected rigidly with the rod f′. The pin f slides in a slot (shown in dotted lines at F^3, constituting a lost-motion device) in the head of the lever F, so that the pin f, after traveling a short distance, comes into rigid engagement with the lever in either one or the other direction. The rod f′ is manipulated by any suitable device located in the carriage, preferably in the body X—as, for instance, the handle G, locked by the notches G′, as shown, and connected to the rod f′ by any suitable means—such, for instance, as the bell crank lever G″, pivoted at G^3. In case the manipulator G is upon the vehicle body X it is found desirable and in fact necessary that some sort of resilient or yielding connection be supplied between the lock handle upon the body and the operated device secured to the axle A. This is shown in Fig. 3 by the spring f″, which presses against the end of the rod f′, the motion being limited by the slot and pin shown at f^3.

Within the vehicle body X is mounted the controller for the motor M (indicated at H), pivoted so as to revolve in journals H′ H′ and supplied at some point in its moving system—for instance, at the base of the cylinder—with a disk g, having notches, one of which is shown at g′, and which serve to allow the segment G^4 to pass freely. The segment G^4 forms a part of the manipulating system or connection for the compound gear, as described above. It will be seen that when the controller is so turned that a notch g′ is presented in the path of the segment G^4 the handle G may be manipulated freely, but if the controller is not so turned that a notch is present, the handle G is locked, and this locking action may take place in either of its extreme positions. This position I will denominate as that in which the controller is out of action—viz., when the segment G^4 is allowed to pass freely, and it will be seen that when the segment is only partially turned the controller will be locked in this position or locked out of action and prevented from turning into any one of its active positions. Moreover, it will be noticed that should the operation of the handle G be stopped in the middle of its excursion—say at notch indicated at G′—the segment G^4 will then be found only part way through the notch, thereby effectually locking the controller H from rotation in either direction, as above referred to. Of course, the notch g′ may be a wide one, so that the lock is effectual only in one direction without departing from the spirit of the invention.

In or about the vehicle and within operating distance of the manipulating handle G or its connected parts is the limit switch or automatically operating self-releasing cut-off or cut-out. The operation of this device is well known and may be briefly referred to as follows:

The magnet i when energized retracts its hooked armature i′, pivoted, as shown, against the spring i″, which has a predetermined tension. The hook co-operates with the nose i^3 of the lever j, which also is furnished with the retractile spring j′. The stationary contact, which may be inserted with the magnet, is shown at k, and co-operates with the contact k′, mounted upon the lever j. When these contacts are closed, the circuit is complete, and the hook i′ engages the nose i^3 and holds the contacts in closed circuit relation against the tension of the spring j′. Whenever the current increases beyond a certain strength, the hooked armature i′ is retracted, releasing the lever j and allowing the spring j′ to open the contacts k and k′. I prefer to re-engage the cut-off contacts or close the circuit by a movement of the handle G for the following reasons, among others: first, the double use of the same handle simplifying construction and operation, and, second, when the limit switch or cut off operates, it indicates that an extraordinary demand is being made upon the motor and may be made to indicate that the compound gear, which greatly increases the leverage of the motor over the load, should be called into operation, and it is natural that the same handle be made in this way to accomplish both purposes—viz., that of increasing the power for the motor over the load, and thereby correcting the cause and re-establishing the circuit, so that its operation may again go forward.

The motor is of any ordinary construction, being cylindrical or rectangular in the main body (shown at M) and is provided with two lateral faces at M′ M′. To these faces are attached the ordinary motor housings E E, which serve to shield the field windings and support the bearings, as is well known in the art. The upper part of the forward and rear wall of this motor housing, together with the top, is shown at E, Fig. 2. Here also are shown three screws, by means of which the housing is attached to the face M′ of the motor M. The only special feature to which attention is desired to be called in this connection is that these housings, while otherwise entirely inclosing the motor and gearing in any of the ordinary well-known methods, are provided with apertures for ventilation (shown at I I I), which are in the bottom and preferably forward in reference to the carriage axle A A′. These apertures are shown as covered with gauze or other means for preventing the sudden inrush of water or "splash" of water or saturated mud, and in the upper part of the housing (illustrated in Fig. 2) is a co-operating discharge aperture (indicated at I′) which, as will be seen, is located in the upper part of the housing and to the rear. The relative locations of these apertures in the housings are for the purposes of facilitating the ventilation and cooling of the motor.

The running frame of the vehicle is clearly indicated in Fig. 5, and the spring support between the running gear and the body is clearly indicated in Figs. 5 and 6. As attention is especially called to the fact that when the body is mounted upon springs, as shown, and a part of the mechanism lying in the body is to be connected with a device mounted upon the running gear some portion of the operating connection should be supplied with a resilient feature. This has been illustrated and described, and will be pointed out in the claims.

From the different diameters of the gears D^3, D^4, D^6 and D increased leverage from their use will readily be understood. It will also be seen that the pinion D serves two other gears—viz., being in constant engagement with the main driving gear C, and also at times with the gear D^6.

UNITED STATES DESIGNS.

No. 642,706.—February 6, 1900. Antonio L. Navone, Calistoga, Cal.. Gas engine.

The inventor has a double-acting engine; the charge being compressed outside the cylinder by a blast apparatus, though the device can be used as any other common form of gas engine when the motor may be started at any time, as when the air reservoir may not be charged. The exhaust takes

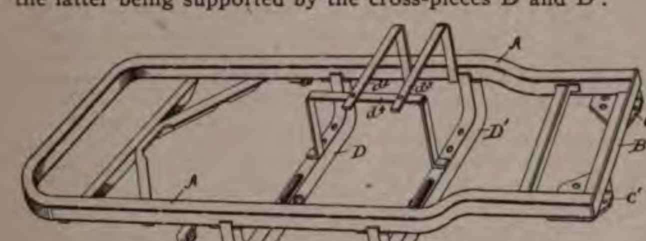
place at the center of the cylinder; the piston being of a suitable length to uncover the port at each end of the stroke.

Six claims. Application filed July 5, 1898.

No. 32,199.—February 6, 1900. W. O. Worth, Chicago, Ill. Design for motor-vehicle frame. Application filed August 19, 1899.

The structure A of the frame is composed of one piece of tubing having a practically square cross-section, but exterior round corners. The tubing is bent into the form shown, the two sides being parallel except at a point near the front, where the parallelogram is somewhat contracted. Near the rear end the structure is bent in circular form at points where otherwise the two corners would appear.

Near the center of the tubular structure A, joining the two sides thereof, is a cross-piece D, bent down, as shown, and connecting the two sides of the tube comprising the parallelogram A. The piece D is composed of tubing similar to that of which the parallelogram A is composed. Another cross-piece D′, similar to D in every respect, joins the two sides of the frame A at a point just in the rear of that where the structure begins to narrow, as shown in the figure. A skeleton framework composed of cross-bars d^2 d^3 rises above the structure A. Said bars are attached to the side thereof, are bent at aright angle, and extend upwardly and inwardly and rest upon an inverted-U-shaped support d^4, the legs of the latter being supported by the cross-pieces D and D′.



The essential features of the design therefore embrace the two parallel side pieces comprising the major portion of the structure, a downwardly-curved cross-piece near the center thereof joining the two sides, another similar cross-piece parallel therewith also joining the two sides of the main portion of the structure at a point practically midway between the first-described cross-piece and the front end of the main structure, a frame attached to one of the side pieces of the main structure extending upwardly and inwardly between the said cross-pieces, the upwardly-extending end resting upon an inverted-U-shaped support, the legs of the latter resting upon the said downwardly-curved cross-pieces.

No. 32,198.—February 6, 1900. C. R. Harris, Williamsport, Pa. Design for body for automobile. Application filed January 3, 1900.

In the accompanying drawings, Figure 1 is a view in perspective, and Fig. 2 is a view in section of the same.

The leading feature consists in a body for automobiles whose sides have a continuous unbroken curved outline.

A represents the dashboard, and B the sides of the body for automobiles. The edge of each side comprises a continuous tubular portion 1. Starting at the point 2 at the base

Fig. 1.

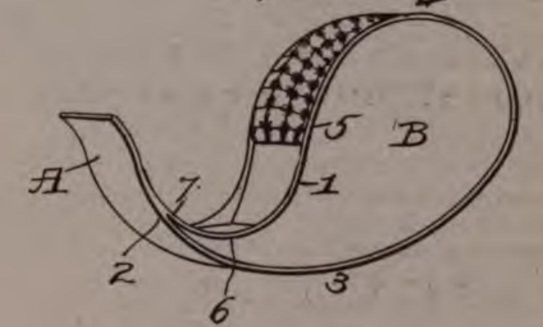
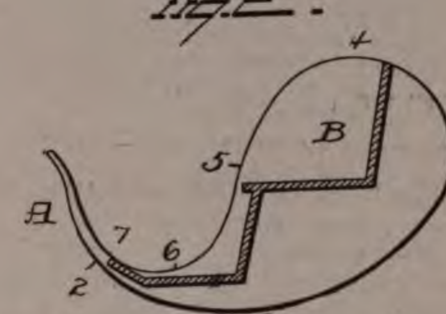


Fig. 2.



of the dashboard A the tubular edge 1 curves gradually downward and rearward to a point about midway the body, as shown at 3, then upwardly to a point 4, so as to mark approximately a semicircle. From the point 4 the tubular edge curves downwardly into an approximately vertical portion 5. At the lower end of the portion 5 the edge is curved rather abruptly, as at 6, and then extends upwardly and merges into the dashboard A, as shown at 7.

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

ALUMINUM • CASTINGS.

Try our new alloy. It is of beautiful silver whiteness, light, strong, easily machined, and reasonable in price.
Intricate Castings a Specialty.

THE ALUMINUM CASTINGS CO.
HYDE PARK, MASSACHUSETTS.

GASOLINE ENGINE CASTINGS.

One to four h. p., for stationary marine or vehicles; rough or partly finished. Also complete engines, carbureters and accessories. LOWELL MODEL CO., Box 292, Lowell, Mass.

NEW SAFETY DEVICE

AGAINST LOW WATER in SMALL STEAM BOILERS.

Indispensable for use on STEAM CARRIAGES.
Can be readily attached to any make of boiler.

SMART & SPENCER, Sole Agents,
SALEM, MASS.

SPECIAL

TURNED METAL PARTS FOR AUTOMOBILES. Made to order from sketch or sample.

DODGE MACHINE SCREW CO., BOSTON.

Automobile Engines—water jacketed, 2 h. p., 100 lbs., or used double with one fly wheel 160 lbs.—now ready, $125.00.

Generator valves, $5.00. Mufflers, $2.00.

Mianus Motor Works, Mianus, Conn.

STEAM VEHICLE FITTINGS.

PIN Valves (both union and plain ends), Injectors, Gasoline Regulators (improved type), Water Regulators, Improved Glass Gauges, Globe and Check Valves, Water Relief Valves for Cylinders, Steam Gauges and Safety Valves.

LOCKE REGULATOR CO., - - Salem, Mass.

ELECTRIC IGNITION

IN GAS, GASOLINE AND OIL ENGINES.

We make special SPARKING POINTS for this service possessing extreme hardness and greater durability than platinum.

SEND FOR DESCRIPTIVE MATTER AND PRICES.

BAKER & CO., Manufacturers of Platinum Products, **NEWARK, N. J.**

WANTED—AUTOMOBILE FACTORY.

A Company with Electric and Gasoline types of Automobiles desires to secure a large and suitably equipped factory near New York, and have owner take interest in the company, and if desired active part in the management. A good opening to the right parties. Address FACTORY,
Care of HORSELESS AGE, 150 Nassau Street, New York.

OPENING FOR AMERICAN AUTOMOBILES IN FRANCE.

An American, thirty-five years of age, having resided three years in Paris and in France where he has most successfully introduced an American article closely identified with Automobiles, is open for engagement for representation of a good petroleum motor. Party in question speaks the French as fluently as English and is in close touch with the trade daily. Representation of a high-grade motor and a first-class house only desired. Best references Paris and New York given.
X. Y. Z. care HORSELESS AGE.

WANTED.

To buy a Locomobile, No. 2 preferred. State price and condition.

Box 756,
New Britain, Conn.

WANTED.

Horseless Carriage, new or second hand. Name spot cash price. Send full particulars.
W. E. S.,
Post Office Box 1,366, NEW YORK.

FOR SALE.
INTEREST IN AUTOMOBILE COMPANY.

Owner of large patent interest in a new, but developed Automobile Co. with Gasoline and Electric Types of Automobiles, is compelled to dispose of part of his interest. A liberal deal will be offered to responsible party and if amount warrants it active interest in the management of the company.
Address OWNER, care of HORSELESS AGE.

Automobile Storage and Repair Co.

Station No. 1—57 WEST 66th STREET (St. Nicholas Rink Bldg.), NEW YORK.

House and Care for Automobiles of all kinds. Storage Batteries Charged and Supplies of all kinds furnished.

Transients Accommodated.

ERT F. BLAKE, Supt. Telephone, 2085—38th.

NHATTAN AUTOMOBILE STATION,

211, 213, 215 WEST 32d STREET,
Office, 214 WEST 33d STREET,
.....NEW YORK.

FIREPROOF STORAGE. COMPETENT SUPERVISION. BATTERIES CHARGED AND CARED FOR.
AUTO'S WASHED AND CLEANED CAREFULLY. Entrance for Auto's, 211 West 32d Street.
Asphalt Pavement Fifth to Eighth Avenue directly into Station.

THE JUMP SPARK LEADS
Give Thick
1 Inch Jump Spark.
Weight, 3 lbs.
Dimensions, 8 x 4 x 4 ins.
Patent Applied For.
C. F. SPLITDORF, ELECTRICAL SPECIALTIES.
21 Vandewater St., New York

ess Cold Drawn Steel Tubing,
, Cylinders and Tanks,

For Air, Gas, Steam, Ammonia or fluids under pressure and explosives.
Seamless Steel Tested Tanks of Sundry Diameters.

DROP FORGINGS AND STEEL STAMPINGS.
Y, STEINMETZ & CO., Drexel Building, Philadelphia, Pa.

Drive Chain,
SPROCKETS.
GEARS. 3,200 Sizes.
Compensating Gears.
Steel Balls, etc.
Boston Gear Works,
138 Purchase St.,
BOSTON, MASS.

TOMATIC LOCOMOBILE RNACE IGNITER - - -

New and simple *electric device* by which *fire in furnace* may be *ignited* or *relighted* at any time, by *simply pressing a button* at the seat. *Permits* of *extinguishing fire* and thus *saving fuel* during stops, or *relighting* while under way *should fire be blown out* by wind.

A. L. BOGART,
123 Liberty Street, New York City,
SOLE MANUFACTURERS.

...ASHTON...

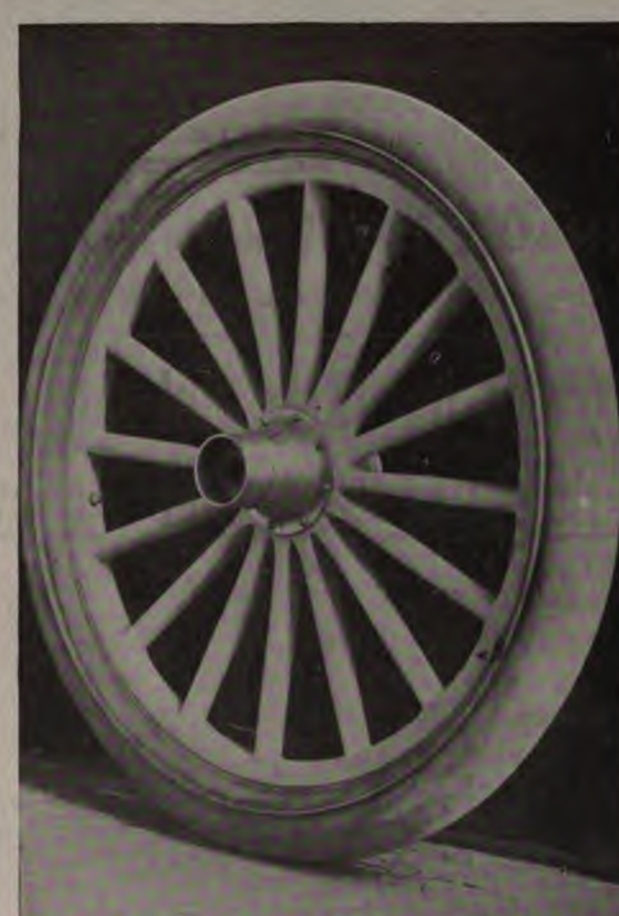
Pop Safety Valves, Cylinder Relief Valves, Steam Gauges, Automatic Water Gauges and Gauge Cocks for
STEAM VEHICLES.

ASHTON VALVE CO., 271 Franklin St., Boston, Mass.
BRANCHES: 121 Liberty Street, New York. 1218 Filbert Street, Philadelphia. 218 Lake Street, Chicago, Ill.

nes, Boilers and Burners
FOR...
STEAM VEHICLES.
MILNE & KILLAM,
10 CRESCENT ST., EVERETT, MASS.
OR CATALOG.

AUTOMOBILE CHAINS....

We are prepared to furnish Automobile Chains suitable for all demands of the trade. Send for Catalogue.
Baldwin Detachable Chain Co.,
Worcester, Mass., U. S. A.



EAMES' MOTOR WHEEL.

A PRACTICAL and Durable Wheel for light and heavy vehicles. Used with success and rapidly superseding the wire wheel. Manufactured by

A. M. EAMES & CO.,
SOUTH FRAMINGHAM, MASS.


Round
the
World
the
Kelly-Springfield Tire
wins its way. The only successful Rubber Tire in the world for vehicles. The genuine has "Rubber Tire Wheel Co." moulded in the rubber. Put on any vehicle by best carriage makers and dealers everywhere.

Sole Licensees

UNDER THE TILLINGHAST PATENTS.

Having acquired the Tillinghast Patents, heretofore held by Theodore A. Dodge, the Single Tube Automobile and Bicycle Tire Company gives notice that the following companies alone are licensed to manufacture and sell Single Tube Tires under said Letters Patent.

HARTFORD RUBBER WORKS COMPANY
KOKOMO RUBBER COMPANY
PENNSYLVANIA RUBBER COMPANY
NEW BRUNSWICK TIRE COMPANY
NATIONAL INDIA RUBBER CO.
DIAMOND RUBBER COMPANY
INDIA RUBBER COMPANY
GOODYEAR TIRE & RUBBER COMPANY
EMPIRE RUBBER MFG. CO.
INDIANA RUBBER & INSULATED WIRE CO.
INTERNATIONAL AUTOMOBILE & VEHICLE TIRE COMPANY
FISK RUBBER COMPANY

For Cycles, Vehicles and Automobiles.

B. F. GOODRICH COMPANY
BOSTON WOVEN HOSE & RUBBER COMPANY
HODGMAN RUBBER COMPANY
L. C. CHASE & COMPANY
MECHANICAL FABRIC COMPANY
NEWTON RUBBER WORKS
REVERE RUBBER COMPANY
PHILADELPHIA RUBBER COMPANY

For Cycle Tires.

Inasmuch as the above list comprises all tire manufacturers of any standing, who are able to supply many times the actual demand for single tube tires and to give the public an ample choice of every style of single tube tire, notice is hereby given that any and all persons who make, sell or use any other single tube tires will be held liable and promptly prosecuted as infringers.

SINGLE TUBE AUTOMOBILE AND BICYCLE TIRE CO.

THEODORE A. DODGE, President.

FOUR HORSE-POWER DUPLEX MOTOR FOR AUTOMOBILES

Lightest Motor for its Power made in the World. Weight, 92 lbs. Air Cooled. No Water Jacket. Speed can be changed automatically from the slowest to the fastest. Electric Ignition. Self-Oiling. Noiseless. No Vibration. . . . .

PATENTED IN AMERICA AND EUROPE. BEWARE OF IMITATIONS.

CREST MANUFACTURING CO., DORCHESTER, MASS., U. S. A.

Complete Lines of UPRIGHT DRILLS

From a light Friction Drill to a 42-in. B. G. P. F. Drill.

SEND FOR CATALOGUE.

W. F. and John Barnes Co.,

996 Ruby Street, - Rockford, Ill.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. V. NEW YORK MARCH 7, 1900. No. 23.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week s notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

Liquid Air Promotion.

Another attempt is being made to exploit liquid air as a motive power for automobiles. Leading newspapers the past week have contained conspicuous advertisements of the Tripler Liquid Air Co., capital stock, $10,000,000, which is said to control all the patents relating to liquid air that have been taken out by Charles E. Tripler, of New York, whose interesting experiments in and extravagant claims for liquid air have brought him prominently before the public of late.

From the statements made in the company's advertisements we select the following:

"The company has a factory in operation in New York City, where liquid air is being manufactured in commercial quantities, and it is being used daily in leading hospitals and for motive power.

"Prof. Tripler's discovery—liquid air—has passed the experimental stage and can now be profitably used everywhere for refrigeration and motive power, as well as in numerous other important lines. Its utility and practicability have been demonstrated beyond question.

"The use of liquid air in the generation of power on land and sea will reduce the cost to one-half of that now paid for steam power. This statement carries its own argument, and needs no elaboration.

"The present weight of an automobile cab averages 3,000 pounds, operated by a storage battery. An automobile operated by liquid air weighs 1,000 pounds, and has 50 per cent. more efficiency at one-half the cost of operating.

"In this case there are special advantages in the use of liquid air over every other power now known to mankind. First, the weight of the vehicle can be greatly reduced, thereby materially lessening its cost."

As to the "factory" of the company and the meaning of the term "commercial" there is room for doubt. The promoters' vocabulary is notoriously elastic. But in regard to the statements made about the use of liquid air as motive power, particularly for automobiles, there is no room for doubt. Liquid air is not to be thought of in this connection. Hudson Maxim, a well-known authority on explosives, who was consulted by the Tripler Co. in regard to the utility of liquid air for blasting purposes, states that their scheme for displacing steam in the world's work is comically unpractical. They propose to make liquid air, extract the pure oxygen from it and burn coal with this oxygen. But inasmuch as pure oxygen would quickly destroy any boiler that could be made, they had decided to mix it with air. In other words they started with atmospheric air and after a complicated and costly series of operations they would again produce air—a fair sample of the witless nonsense that has been palmed off on the public in the name of science, during the year of insanity, 1899.

Liquid air has no apparent field as a motive agent. Its manifest inferiority to steam in this respect, not to speak of the mechanical difficulties of utilizing it, have been conclusively proved by numbers of chemical engineers, who have had occasion to investigate it. It has been shown that if liquid air were as cheap as water it could not compete with steam, as motive power, and the complicated apparatus that would be required to control its tremendous pressure, and prevent the freezing of the pipes and valves, would add greater difficulties than those met with in the harnessing of compressed air. Air is free; liquid air is a manufactured article, and therefore a charge at the very outset.

It is sometimes hard to fix the mental responsibility of the inventor. He is frequently so infatuated with his hobby as to lose the faculty of reason. The true proportions of things become obscured in his mind and he becomes what is termed a monomaniac. We regret that Mr. Tripler has given evidence that he belongs to this class of inventors. His researches in this field have been very interesting and will no doubt lead to valuable results, but the claims he makes are simply impossible. The errors have been fully exposed by such authorities as Professor Morton, Professor I. L. Roberts, Hudson Maxim, and others. A moment's thought will convince any candid person that his assertions cannot be true, unless he has succeeded in contravening every known law of thermodynamics and performed a miracle.

The promoters will perform as great a miracle, however, if they succeed in disposing of their stock on such representations as these.

Storage of Calcium Carbide.

The storage of calcium carbide in large quantities for lighting purposes in cities is attracting the attention of fire department officials, who find in it a menace to the public safety. In cases of fire the water thrown on the burning building would no doubt reach the carbide and quickly generate acetylene gas, which rising to the flames, would cause an explosion, or if the place where it was stored was damp the moisture would attack the carbide and generate a gas which would ignite instantly if a match were struck, or a lamp brought into the room. The firemen have had one or two unpleasant experiences with calcium carbide already, and it is probable that laws will be enacted regulating its storage in cities.

More Anglo-American Bluff.

The Herald's European edition publishes the following:

For the Paris-Bordeaux automobile race three entries have been made in the name of the American Rapid Vehicle Co., the drivers being C. G. Gridgway, Charles Jarrott and E. J. Pennington. The carriage in each case, as described in the entry, will be of twenty-eight horse power, with a weight of six hundred kilogrammes.

"With the competitors named," says Georges Pradel, in the Vélo, "we are acquainted, but should the entry, as far as machines are concerned, be correct and not a 'bluff,' then the constructors on the other side are far ahead of those in France. Here the latest creation which appeared in public is Reaé de Knyff's carriage, with which in the recent Pau circuit race he obtained an average speed of seventy kilometers an hour.

"But this machine is far inferior in comparison with the automobiles which Mr. Winton's countrymen 'by letter' promise to bring. It is of the twenty horse power class, or, in reality, above twenty-four horse power, with six horse power per cylinder, and weighs 960 kilogrammes. This is about forty kilogrammes per horse, and is the best result as yet obtained. Those entered by the American company will, therefore, be equal to a weight of but twenty-one and a half kilogrammes per horse power.

"The entry also states that the machines are of the torpedo type and can travel at a speed of from forty to one hundred kilometers per hour.

"With such motors in existence," says M. Pradel in conclusion, "Americans need look no further for machines capable of bearing their colors to victory in the International Cup contest. There is no doubt that in the last named race there will be faster machines than the one owned by M. de Knyff, but twenty horse power for six hundred kilogrammes is almost too good to believe.

"However, the great thing is that Americans are coming and 'qui vivra verra.'"—New York Herald.

All those who are familiar with the career of E. J. Pennington, and the history of the Pennington-Lawson promotion in England will be moved to laughter by this announcement. For more than four years Pennington has been issuing challenges to all Christendom to meet him on the race track or on the road for a consideration. Up to the present time, however, Pennington's laurels are still to be won. They are not likely to be won in the Gordon Bennett International Race, inasmuch as all contestants must enter as representatives of the recognized automobile clubs, of which the Automobile Club of America is one. Is the Automobile Club of America ready to take Pennington under its wing?

The newspapers can render better service to the cause of automobilism than by publishing without comment the empty boasting of these braggadocios. Let the other side of their career be shown so that the public may judge for themselves as to the character of the men and the merit of their pretensions. The legitimate function of a newspaper is public service. This sometimes involves a temporary sacrifice, but the willingness to make that sacrifice is the test of the virility and sagacity of its management. Perhaps the Pennington-Lawson syndicate is deemed too small a matter to engage the attention of the daily press. The sporting editors find it of sufficient consequence to fill columns with the plans, prospects and glorification of the syndicate. This, of course, is business.

Lawsonism in England.

We have already suggested that the American tour of Pennington and Lawson was most timely for them. Recent occurrences in London motor vehicle circles give strength to our supposition. The paper of the Hon. J. Scott Montagu, M. P., recently read before the Automobile Club of Great Britain and reprinted in part in this issue, was devoted principally to a denunciation of these men and their methods. The honorable gentleman stated at the outset that these financial scandals had became so flagrant that several influential members of the club, including himself, had decided not to purchase any vehicles made by the Lawsonian clique, but to go abroad for their

carriages until British motor vehicle manufacture was on a sounder basis.

The decision is well taken, and will, no doubt, bring some of the weak-kneed builders, who have been intimidated into making common cause with Lawson, to their senses again. Lawsonism must be extirpated, root and branch, before the motor industry will deserve the support of self-respecting men. Members of the Automobile Club of America might profit by the experience of their English confreres and quietly make the same resolution. A little firmness and candor on the part of the influential members of the club will rid the American industry of this incubus.

The Automobile Club's Exhibition.

The Automobile Club of America has decided to hold a trade show of automobiles and accessories at Madison Square Garden, New York, some time in November. The Garden will be specially prepared for the occasion. A track will be constructed so that the vehicles may be seen in motion and various tests may be conducted to demonstrate the efficiency of the machines. Although the general announcement has just been made and no spaces have yet been allotted, applications for nearly half the floor space have already been received. The club will exercise a supervision over all important details, ensuring a creditable exhibition in every respect. All who have the interests of the new industry at heart will be pleased at the announcement and will prepare for the event with full confidence that it will be a complete success.

Advocating Good Roads.

Albert R. Shattuck, chairman of the Good Roads Committee of the Automobile Club of America, appeared before the Ways and Means Committee of the New York Assembly last week to urge an appropriation of $1,000,000 for the improvement of the highways of the State according to the provisions of the Higbee-Armstrong bill, which was passed two years ago, and under which only $100,000 has been appropriated by the State, and only $88,000 of this sum has been spent. According to the above mentioned bill one-half of the expense of improving the roads is borne by the counties in which the improvements are made. The people are evidently willing to bear their share, but the Legislature is dilatory in making the appropriations.

Jacketless Motors.

Reports from abroad confirm the opinion, frequently advanced in these columns, that jacketless motors of over 2-h.p. are not reliable and efficient. Premature ignition will take place and reduce the power obtained or stop the motor altogether. French makers of voiturettes, who undertook to utilize cooling ribs instead of water jackets on motors of this size have abandoned them in favor of jacketed motors, which may be somewhat heavier and more complicated, but which give the required power.

Educates His Neighbors' Horses to the Automobile.

A prominent member of the Automobile Club who resides in the suburbs has adopted a very excellent plan to educate his neighbors' horses to the automobile. He has advertised in the local paper that if any of his neighbors wish their horses trained to the new machines he will, upon request, bring his automobile to their stable and have the horses properly broken to it. In this manner he conciliates his neighbors and relieves himself of responsibility should any horse belonging to a fellow townsman take fright at his motor.

Results.

At the temporary show room of the Anglo-American Rapid Vehicle Co., Twenty-seventh St. and Fifth Ave., a number of Pennington and Daimler vehicles are on exhibition, as also a motley assortment of carriage bodies detached, and a few English built De Dion tricycles. The visitor is informed that the vehicles on show are not suitable to the American trade, but that the company expects to have its American carriages ready for the market in a few months.

Whipping the Dead Horse.

The Hon. J. Scott Montagu has denounced Lawson motor finance at the Automobile Club, and we are glad of it. The only regret is that the denunciation comes so late—when Lawson motor finance is already discredited, when the shares of the companies are generally regarded as the rubbish which they assuredly are. Now, if the Hon. J. Scott Montagu had come to the aid of some of us three or four years back, when Mr. H. J. Lawson was issuing prospectuses inviting subscriptions to millions sterling of capital, he could have helped in warning investors against parting with the money which they have lost. It is rather late in the day now—still, better late than never. As we say, the Hon. J. Scott Montagu has denounced Lawson motor finance at the Automobile Club, and we are glad of it.—Westminster Gazette.

LONDON NOTES.

London, Feb. 15.

GENERAL ASPECTS OF BRITISH AUTOMOBILE MANUFACTURE.

This was the title of a paper read at a meeting of the Automobile Club of Great Britain last night by the Hon. J. Scott Montagu, M. P. The paper proved to be a veritable surprise, and has caused an unusual flutter in motor circles here, it being the most virulent attack that has so far been made on the Lawson and Pennington doings of the past few years.

The paper, the major part of which is reprinted, was as follows:

The General Aspects of British Automobile Manufacture.

In the early days of any industry there is a difficulty which always arises, namely, how to induce the private capitalist, or the British public, to support schemes to manufacture articles of which they know very little, and in the success of which they do not believe. If you look back to the early days of railways you will find that this was essentially the case, and the same thing has happened in the process of automobile manufacture. Necessarily, much experimental work has to be carried out which, though it may mean an expenditure of thousands of pounds, may, in the end, be absolutely unproductive of commercial results. In the motor industry this is particularly the case, and any one who has had experience of experimental work in connection with motors knows that experiments and deviation of any kind from the accepted and proved models which have run and performed successfully on the road mean great loss of money, and results, in most cases, insignificant to the work performed. There is also a tendency to attach exaggerated value to patents, which in the motor world are very often not patents at all. One of the most cruel drawbacks under which a young industry can suffer is that of overcapitalization, and this, I am sorry to say, has been rampant in automobile manufacture. This is all the more regrettable because the British public showed a distinct sign some four years ago of giving support to British motor companies. To-day the position is that the British public as a rule are unwilling to place any further funds in the motor industry, and the private capitalist is not yet convinced that the movement has come to stay.

It is impossible for me to deal adequately with this subject without referring to the most distasteful subject of bad finance. I shall deal with this aspect first. Some people treat bad finance as if it were an indecency to mention it; others as if no one had the right to criticise the methods employed or the men responsible for it. But many members of this club agree with me that the time has arrived when it should be clearly stated that a large number of men in this club have made up their minds not to support any motor company which associates itself with Mr. Lawson or concerns promoted by him. I may state that when the name of the Daimler Co.'s chairman appeared on the Committee of the Motor Trades Association, which was promoted by and is presided over by Mr. Lawson, I and many other members, and even gentlemen not connected with this club, resolved to cease to give that company orders, and to buy our motors from abroad or from some company which showed sufficient self-respect and foresight to keep aloof from everything with which Mr. Lawson is connected.

The Daimler Co. has, I believe, altogether withdrawn from the Motor Trades Association and has thus prevented the estrangement of customers who, to my knowledge, were about to order or had ordered some £5,000 worth of motor vehicles.

The question is asked, Why is there this strong objection to Mr. Lawson? and the answer will be given in the following remarks.

I do not propose to deal with the crude and weird motors which were built in the thirties, but to begin my review about the year 1896, when there first appeared to be a probability of the law allowing the use of light locomotion on the highways.

Whilst Sir David Salomons, Mr. Worby Beaumont, the late Mr. J. T. Hopwood and other members of the club were pointing out to the Government and the public the advantages of self-propelled road locomotion, Mr. Lawson was acquiring two valuable patents, namely, the Daimler patent and the De Dion patent. He also acquired a large number of other patents which had little or no value. This was legitimate enough, and to form moderately capitalized companies to acquire those patents might also have been a legitimate proceeding, for honest company promotion is as honorable a trade as any other. But the property sold to a company must be good and sound, and the price asked, including the profit, fair and reasonable. But when company promotion is accompanied by misrepresentations of fact and suppression of material details, and is, in consequence of such misrepresentation, the means of strangling a promising industry and of ruining hundreds of investors, then I say that the promoters of such companies are men to be avoided as one would avoid a pestilence.

There is not the slightest doubt that the public were ready to give support to this new industry at its birth; otherwise there would not have been public companies floated in connection with motor concerns in 10 months in 1896 with total capitals amounting to no less than £2,300,000, as was indeed the case.

The Daimler Co. was floated by Mr. Lawson in February, 1896. There was a rush for the shares. The company purchased certain but not sole rights in the Daimler patents from Mr. Lawson's British Motor Syndicate for £40,000 in cash. I say Mr. Lawson's syndicate, because in April of that year he owned £100,000 of its £150,000 shares.

As an example of the unsound finance of these proceedings I will read you an extract from the report of the shareholders' committee of investigation into the promotion of the Daimler Co. The committee consisted of Messrs. Rawlinson, Avery and Leake.

Their report states:

"The British Motor Syndicate, Ltd., or its principal proprietors, appear to have been the promoters of the Daimler Motor Co., and to have in fact nominated the directors. As such syndicates were also the licensers of the patents to the Daimler Motor Co., Ltd., the interests of the latter company were not independently represented in the matter of agreement for the license. We are of opinion that the sum of £40,000 cash which was paid for the license was excessive; the license, moreover, was not a sole license, but the British Motor Syndicate, Ltd., retained the power to subsequently license any number of competitors, the only restriction being that no other licenses were to be granted on as favorable terms.

"In the omission of important facts the prospectus appears to us misleading. The effect of the agreement made between the British Motor Syndicate, Ltd., and the Daimler Motor Co., Ltd., is therein set forth as follows:

" 'This company purchased a license to use all or any of the celebrated Daimler patents in the United Kingdom, together with the benefit of all further improvements, so far as the same may relate to the motor by the said Gottlieb Daimler, for the price of 4,000 shares, or cash in lieu thereof, as provided by the said contract.' This quotation sets forth what the company was acquiring, but admits the onerous conditions imposed by the British Motor Syndicate, Ltd. One of these was the right to nominate two directors on the board of the Daimler Motor Co., Ltd., and Messrs. H. J. Lawson and Bradshaw were nominated under this clause, though neither their names nor the clause under which they were nominated appear on the prospectus.

"Another and more important omission from the prospectus was an obligation on the part of the Daimler Motor Co., Ltd., to assign to the British Motor Syndicate, Ltd., all improvements the said Daimler Co. might effect or become the owners of in respect of the invention or the mode of applying the same. The effect of this obligation was that the benefit of all improvements effected by the Daimler Motor Co. would be made over to the British Motor Syndicate, Ltd., who would then be at liberty themselves to manufacture the motor thus improved by the Daimler Motor Co., or to license any number of other persons to do so in competition with the Daimler Motor Co."

The facts brought to light by the report of the investigation committee are, I think you will agree, gentlemen, sufficient to make it impossible for any self-respecting man to associate himself directly or indirectly with the person or persons who were responsible for the Daimler Co.'s prospectus.

In May, 1896, Mr. Lawson floated the Great Horseless Carriage Co., with the ridiculous capital of £750,000, of which £500,000 went to the British Motor Syndicate, although, be it remarked, four months later only £31,160 worth of shares stood in the name of that syndicate.

At the end of 1896 the wide awake portion of the British public commenced to recognize the tricks to which they had been subjected. Honest journals began to expose the systems hitherto employed by Mr. Lawson.

I think that by now almost every one interested in automobilism knows that the patents held by the British Motor Co. are of little or no value.

Much bluster is made in the company's advertisements about them, but with the exception of possibly the particular form of carbureter used on a Daimler engine, I do not believe there is any patent which would be infringed by the building of a complete copy of the Daimler car. I further believe that if the rest of the patents held by the British Motor Co. were put up for auction to-morrow, including the patent for blowing a horn off the exhaust, they would not fetch £100. I do not wish to damage the prospects of any trading company, or to interfere with any man's rights, but in the general interests of British automobilism, which has been bluffed and cramped by loud but idle threats of actions for infringement of alleged master patents, etc., I feel it my duty to speak plainly before such an audience as this, of the value and extent of the so-called patents..

I cannot leave this unpleasant subject without mentioning briefly three other more recent matters which are connected directly or indirectly with British manufacture.

Firstly, of the Motor Trades Association, recently promoted by Mr. Lawson, and of which he is president. I wish to state emphatically that the association does not now represent, and is never likely in the future to represent, British automobilism, since the principal manufacturing companies, such as the Daimler Co., and Thornycrofts, Marshalls, etc.—in fact, the companies which have really turned out the British motor cars, do not belong, and, I am convinced, never will belong, to it. I question if the companies at present belonging to it have ever constructed, sold and put on the road six carriages with motors of their own manufacture.

Secondly, and this is a more delicate matter, I feel I must mention the so-called Motor Car Club, founded by Mr. Lawson, used extensively by him in connection with company promotion, and subsidized by the British Motor Co. to the extent of over £4,000 and £2,000 in two consecutive years. Major Crompton made an attempt last November to defend the public from further misunderstanding by seeking to obtain the names of the committee of this so-called club. But in spite of this public challenge the names of the committee were refused. The Automotor, in August, 1897, neatly described this club as being "ostensibly social in its aims, but really a commercial adjunct to a business," and stated that it "did not command the support of leading British automobilists." This is the truth in a nutshell.

Thirdly, I cannot but refer to another matter which has been a great hindrance to automobile progress in this country, namely, the courses pursued by Mr. Lawson's present business companion, Mr. Pennington. Undoubtedly owing to specious and misleading advertisements many people ordered and paid deposits for these cars, such as the correspondent in last week's Autocar, and have become sickened by long delay and evasive answers, and, moreover, they never have been able to obtain delivery of their vehicles or the return of their money paid on deposit or in full. This fact cannot be too widely known. I can speak from personal knowledge on this point. My brother-in-law, Mr. Henry William Forster, Member of Parliament for the Sevenoaks Division of Kent, now a candidate for this club, more than a year ago paid a deposit for his Pennington, and now cannot obtain either his car or any reply from Mr. Pennington or from Mr. Baines, and is taking legal advice for the recovery of his money, which has apparently been obtained by misrepresentation and fraud. The common street thief may be more violent in his methods, but, at any rate, he does not pretend to be an honest automobile manufacturing concern. The Pennington car as advertised has been a conspicuous failure. There is, as far as I can ascertain, no record of its ever having traveled any considerable distance, or even 20 consecutive miles. In fact, I believe the longest journey ever made by one (I say, advisedly "by," for the driver during part of the journey was "by," not "on," the car) was 80 miles, and that journey comprised, it is said, three days of hard pushing.

I have specially referred to:

1. The Motor Trades Association, which is not an association, but an attempt to corner the manufacturers of automobiles.

2. The Motor Car Club, which has not been a club.

3. The Pennington car, which is not a car, since it does not carry, but has to be carried—in fact, mainly exists only upon paper. There was one on show at Richmond, but it refused to work, even at the hands of Mr. Pennington's most experienced mechanic.

These are three of many influences which have prevented, or are preventing, the healthy growth of automobilism in this country, and also because they will probably be used as levers by Messrs. Lawson and Pennington in their attempt to float in America a motor company for $75,000,000, or nearly £19,000,000. My advice to our American cousins is to leave anything with which either of these gentlemen is connected severely alone.

I am glad to have done with the nauseating subject of this unsound finance. It has had so damning an effect on automobilism in this country that it was impossible not to refer to it at length and in no measured terms, and it is right that the members of this club should realize the real facts.

Naturally, the paper gave rise to an unusually brisk discussion, in which Mr. Gretton, of the Motor Manufacturing Co.; Mr. S. F. Edge and others took part, and finally, at nearly 12 p. m., it was resolved to continue it a fortnight hence. What action Lawson and Pennington, who are at present in America, will take in respect to the attack, is the question that every one here is now discussing.

AUTOMOBILES FOR MUNICIPAL PURPOSES.

The Chelsea vestry has for some time been considering the question of adopting motor-wagons and lately called for tenders for the supply of three steam vehicles. Before deciding, their surveyor was instructed to make further inquiries. This gentleman's report has made its appearance this week. It is a lengthy one and we therefore only extract the "conclusions."

"In conclusion, I must remind the vestry that the estimates they had submitted to them were as follows:

	Each Van.	For 3 Vans.
1. Messrs. Coulthard & Co., of Preston........	£475	£1,425
2. The Lancashire Steam Motor Co., of Leyland:		
For coke-fired Motor..................	490	1,470
For oil-fired Motor.....	510	1,530
3. Messrs. E. H. Bayley & Co., of London, S. E.	650	1,950
4. The Steam Carriage & Wagon Co., of Chiswick (Thornycroft's)	700	2,100

"As regards the annual cost of such vehicles, I have summarized the estimates of cost submitted by each firm, taken the depreciation at 15 per cent. and the wages of the driver at £90 per annum. This will afford a comparative statement as far as possible on the makers' own figures.

Annual Cost.

Maker of Van.	Coulthard.	Lancashire Motor Co.	Bayley.	Thornycroft.
Prime cost.............	£475	£490	£650	£700
Depreciation 15 per cent.	71 5 0	73 10 0	97 10 0	105 0 0
Repairs	75 0 0	55 0 0	52 0 0	52 0 0
Fuel, oil, etc............	82 0 0	75 8 0	36 2 4	44 8 0†
Driver	90 0 0	90 0 0	116 0 0*	90 0 0
Total	£318 5 0	293 18 0	301 12 4	291 8 0

* This includes a boy to assist the driver.

†The difference between this amount and Messrs. Thornycroft's estimate of £37 is owing to that estimate being for five days' work per week instead of six days as the other estimates are.

"It is for the vestry to decide which tender should be accepted. They directed me to see some of the motor vehicles at work; I have done so, and my investigations have confirmed me in my opinion previously expressed, that sanitary authorities in large towns should do their utmost to encourage the use of mechanically-propelled vehicles, which can now be efficiently manufactured by reliable firms such as those four who have lately submitted estimates to the vestry."

LARGE ELECTRIC VEHICLE.

When in Piccadilly the other afternoon I saw a new electric vehicle which reminds one very much of the Waverley coach. It is, however, much larger, having seating accommodation for no less than 13 persons. Further inquiries elicit the fact that the vehicle is the production of the Electrical Undertakings, Ltd., of Camdentown, N. W. The electrical energy is supplied by a battery of 80 Leitner accumulators, the capacity of which is stated to be sufficient to run the vehicle a distance of 80 miles on one charge. The vehicle is driven by two Lundell motors, geared by pinions to internally toothed gears bolted to the rear wheels. The controller switch acts both on the battery and motors and is arranged to give six speeds forward, two backward and electric brakes. Notwithstanding the heavy weight of the vehicle, about 3½ tons, it appears to run easily and noiselessly.

NEW ROAD LOCOMOTIVE.

A new road locomotive of the traction engine type, specially designed for long journeys, has just been completed by Clayton & Shuttleworth, of Lincoln. The water carried is sufficient for a run of about 10 miles with full load. There is a footboard running the full length of the boiler barrel, which allows the driver to have access to all moving parts without dismounting. There are two speeds, the "fast" being 4 to 5 miles an hour and the "slow" 2 to 3 miles an hour. The driving wheels are 6 ft. 6 in. in diameter and have a width of 1 ft. 6 in. The working steam pressure is 150 lbs., the cylinder is 9 in. in diameter and 12 in. stroke, and the fly wheel is 4 ft. 6 in. in diameter. The firebox is of the ordinary locomotive type, adapted for burning coal. This engine has undergone a somewhat severe road test. This was the hauling of a load of 30 tons, made up of a 25-h.p. portable engine filled with water and a trolley loaded with pig iron up Canwick Hill, near Lincoln. This hill is long, and for some distance the gradient is as much as 1 in 9. The test is stated to have been in every way successful.

TO PREVENT THE CIRCULATING WATER FREEZING.

I learn from the current issue of the Automobile Club Notes, that Henry Edmunds, one of the members, has been carrying out a series of tests to ascertain the best mixture of glycerine and water for use in the water system of motor-carriages during frosty weather. He finds that water with 30 per cent. of glycerine is the best mixture. His experiments showed that with 18 degrees of frost this mixture did not freeze at all.

AUTOMOBILES AND WINTER.

Reading in your last issue to hand an account of the behavior of horseless vehicles in the snow at Boston, reminds me of the severe weather we have experienced in this country during the past week. Last week was unusually cold and frosty, but this did not deter ardent automobilists from taking out their carriages for a trip. It has even been remarked in motor circles in London that the bad weather seems to have brought out an additional number of vehicles rather than a shrinkage. On Saturday night last we in London were favored with one of the heaviest snow storms experienced for a long time past, and within a few minutes the dry and clear roads of the afternoon were covered with several inches of snow, through which I saw quite a number of carriages ploughing their way quite unconcernedly. The following day—Sunday—was by no means an attractive one for outdoor exercise, but not a few well-known London chauffeurs were seen on the main roads, apparently enjoying their trip, notwithstanding the wretched condition of the roads. It has often been said that the automobile is only a fair weather vehicle, but the way horseless carriages have conducted themselves during the trying conditions of the past week must have done much to remove this erroneous impression.

FROM HONG KONG TO PARIS.

It is announced this week that Dr. Lehwess, of the Automobile Association, Ltd., who contemplated an attempt to ride in a Koch kerosene carriage from Hong Kong to Paris this spring, has been compelled to postpone the trip until early next year, owing to the impossibility of completing the necessary arrangements in time.

INSANITARY CONDITION OF STREETS.

A very interesting paper was read at a meeting of the Sanitary Institute last night by W. N. Blair, the engineer and surveyor of the St. Pancras Vestry, on the subject of "The Insanitary Condition of London Streets." In concluding his remarks Mr. Blair expressed the opinion that so long as horse traction continued we should be unable to keep our streets in a condition which would escape complaint, for, besides the droppings distributed continually, there was also the ultimate gravelling and watering, the latter natural or artificial, necessary to prevent the slipperiness or to lay the dust. The grinding up of all those by passing wheels insured plenty of work for the scavenger, and until motor traffic became general he feared that no material improvement in the cleansing of our streets, coming within a reasonable limit of cost, could be secured.

COMMUNICATIONS.

The Best Mixture.

Kingston, N. Y., Feb. 26.

Editor Horseless Age:

I have seen several inquiries as to the proper mixture to use in gasoline engines. I think the following will help many.

The most satisfactory way of using gasoline in a gas engine is by feeding the oil through a proper valve into the air pipe as near the valve as possible, giving the engine all the air it wants and regulating the amount of oil by a needle valve.

A valve of this description, once adjusted, should need no more regulating, summer or winter.

I offer a sketch of a valve and method of attaching to engine in Fig. 1. a is of soft steel; B is a brass casting; c, the needle valve; D, jam nut (under which a piece of cotton-wicking should be wound before setting up, to keep the needle valve from leaking); e, cap for the same purpose; f, spring to close valve; g, washer to hold spring in place; h, nut; i, pin; j, an ordinary globe valve, to close when engine is not in use; K, an extension of the air pipe; l, a brass or malleable iron T; m, brass wire cloth rolled loosely to spray the oil; n n n n, small set screws to keep valve in place, and o, the air valve.

This valve can be placed in any position, as long as the oil is allowed to flow in by gravity from the gasoline pipe to the air valve.

Fig. 2 is a plan of a cam, which might be used to vary the speed of the engine by having means of changing the point of contact of the cam lever. If the speed of the engine was 500, the lever would make contact from a to a, but if wished to run at 250, it would make contact B to B, and so on.

This valve would need a hit and miss governor if any was used.

G. C. PARISH.

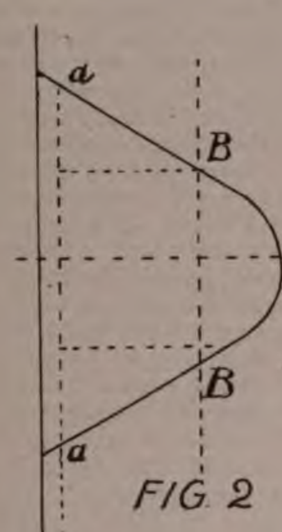


FIG 2

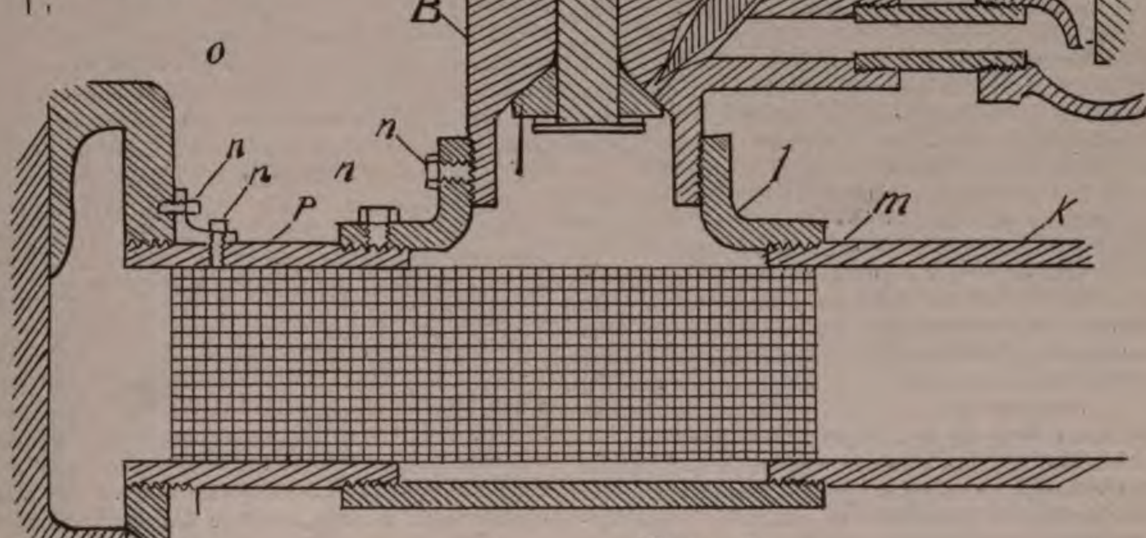


FIG. 1.

PLAN OF VALVE AND CAM, BY G. C. PARISH.

A "Promised" Revolution in Motor Vehicles, by Another Discredited Expert.

Brooklyn, N. Y., March 5.

Editor Horseless Age:

We have received some cuttings from the English newspapers which announce that Hiram S. Maxim, of automatic gun fame—not Hiram Percy Maxim, but the father of the latter gentleman—has issued a prospectus of a syndicate calling for the modest sum of £25,000 ($125,000) for the purpose of experimenting in the building of vehicle motors.

According to Vanity Fair, one of the papers, Mr. Maxim makes the following statement in his prospectus:

"I shall be able, with the expenditure of a relatively small (say £25,000) sum of money, to produce a motor which will open a completely new epoch in the motor car industry."

Vanity Fair queries the modesty of the sum asked for. It is noteworthy that Mr. Maxim makes the above statement as a fact, not as a belief. To be able to make such a positive statement we are to assume that he must have conducted some practical experiments to warrant his claims. If this be true, and he is so very certain that he will be able to open a completely new epoch in the motor car industry, it is strange that he requires such a large sum as $125,000 for experimenting.

It is evident from the foregoing quotations that Mr. Hiram S. Maxim's scheme does not command the entire confidence of the London press. This is, perhaps, not to be wondered at, when we recall his similar enthusiastic predictions for the success of certain other of his schemes which have failed to realize the expectations of investors, notable among which was the flying machine, which did anything but fly.

It is said that upon this chimerical enterprise alone he expended upward of $150,000. Some months ago we noticed in the London press announcements of the organization of a syndicate for developing, manufacturing and selling certain of his electrical inventions. A little later came the announcement of the liquidation of the syndicate. The opening of a new epoch in the electrical industry must have failed on that occasion for some reason.

In an interview in Industries and Iron in the early part of 1897 Mr. Hiram S. Maxim made the following statements:

"What I have started out to do is to make an ideal gas engine for the purpose—an engine which will run fast or slow in either direction, will make no smell, and one which will not require any gearing for the various speeds—something that can be handled after the manner of a locomotive engine, but without the boiler. I have made every stroke of the drawings myself, with my own hands, and I feel convinced that when it is finished it will fill the bill and will, if I am not very much mistaken, be the motor that every one has been looking for. But I am also experimenting on other motors. The one above referred to is an engine for working with heavy petroleum oils, such as kerosene. I am also working on one for using naphtha, or benzoline, as they call it; and I am also working on steam motors. I think I have evolved a system of a generator which will answer better than anything heretofore made for the purpose. I am interested to some extent in a concern where modified flying machine engines are used for steam launches. We recently applied one of these modified motors to a steam van, and it seems to perform very well indeed, traveling on a level road at the rate of 16 miles an hour, and we find it is able to mount all the hills that we have so far encountered. The new feature that I shall have in my steam motor will be that it will take care of itself. Both the fire and water will take care of themselves. It requires no attention as far as taking care of the water."

In Industrial Finance of the same date Mr. Maxim makes the following statement:

"From what I have seen, the public were anticipating that a Maxim motor company was to be brought out some time or other. In fact, I did intend to bring one out, but I did not intend to bring it out until I had developed something which was better than anything in the market. A good many people have approached me with a view of bringing out a company in my name, but I have refused in every instance.

"It has also been known that I have been experimenting for a long time with a view of evolving certain motors for driving horseless carriages."

We learn from Mr. Maxim himself that he had in 1897 already been experimenting for a long time, and that he had then evolved many remarkable things. He was modest, however, and declared that he did not intend to bring out a company until he had "developed something better than anything in the market."

We should naturally expect that, in view of the great promise of the industry and the success of the experiments he had then already completed, Mr. Maxim would, not being cramped for means, have had some of his motor carriages out and going by this time. Furthermore, in view of his statement that he did not intend to organize a company until he had developed something better than anything in the market, he should have something practical to show—something more tangible than promises—before calling for $125,000 for the purpose of experimenting.

Basing our judgment upon Mr. Maxim's own claims for his transcendental abilities, it is hard to divine the reasons lying behind the call upon the public purse for $125,000.

The Horseless Age has predicted from the first that the motor vehicle industry would be one of a modest, healthy growth, and that, in view of the immense amount of work which preceded the real birth of the industry in motors of the various descriptions, there would be no broad foundational patents possible which would give to any one inventor a monopoly. It is true that there have been, and we may still expect, broad and valuable patents, but there are too many smart, capable men, too many thoughtful, practical engineers in the field to permit any one man, even Mr. Hiram S. Maxim, to leap head and shoulders before all the others. Inventors in this industry will have a neck-and-neck race. But there will be room and wealth for all the capable and all the deserving.

During the war with Spain an Ohio farmer wrote to the United States War Department stating that he had invented a gun which could be loaded at the breech instead of at the muzzle, and that it did not require any ramrod. He said this might appear strange to the Department, but he assured them that the trick was perfectly feasible. The War Department sent him a catalogue of the Winchester Repeating Arms Co. The farmer, having remained encased in his little backwoods environment for a third of a century, had not progressed in his information above the old ramrod days.

Those who promise with such assurance motor vehicle revolutions by the Lead Cab route, or by virtue of flying machine brains, should subscribe at once to The Horseless Age.

Yours truly,

HUDSON MAXIM.

Thermo Siphon Water Circulator.

St. Louis, Mo., Feb. 27.

Editor Horseless Age:

In this week's issue I notice in the "London Notes" mention of a thermo siphon arrangement for circulating the jacket water on a gasoline motor without the use of a pump. I should like to know how this is done and would greatly appreciate a detailed description of the device, showing its principles of operation. GEO. E. UGLAND.

The "thermo siphon arrangement" referred to is most probably a simple gravity system, similar to that used with stationary gas engines when water is scarce. In this system the tank is so placed as to bring the lowest water level well above the level of the motor. A pipe then connects the bottom of the tank with the lowest part of the jacket, and a return pipe leads from the top of the jacket to a point in the tank above the outlet pipe, but below the water line. As the difference in density between the hot and cold columns of water is the only reliance for circulation, and as this will be slight, owing to the whole body of water becoming heated, the pipes should not be too small. The arrangement is simplicity itself, and its operation is quite satisfactory, so long as the water level is not allowed to fall below the mouth of the return pipe.

It will be noted that the water tank in the vehicle shown is just beneath the body, under the forward seats, while the motor is in the large casing and lower down. If any "siphon" is used it is probably merely to carry the piping over an obstruction, and it is not an essential part of the apparatus.

HERBERT L. TOWLE.

Liquid Air Fallacies.

Brooklyn, N. Y., March 5.

Editor Horseless Age:

Through all the historic ages, undeterred by all manner of vicissitudes and disappointments, the unphilosophical but mechanical mind has striven unceasingly to produce perpetual motion. On his blind, short-sighted enthusiasm the perpetual motion crank has staked his all, and the shores of time are strewn with the wrecks of his hopes and fortunes.

The warning voice of the physicist and philosopher and all arguments have been fruitless to swerve a genuine perpetual motion enthusiast from his determination.

Even to-day, under the full noonday glare of mechanical and physcial science, there are those who claim to be able to multiply mechanical power.

The cog wheel and clockwork crank is less in evidence than formerly, but the fattened author of the mystic Keeley motor was but yesterday among us.

In The Horseless Age of April 5, 1899, I exposed certain fallacies concerning carbonic acid gas as a motive fluid, and at the same time set forth the limitations of compressed air and carbonic acid and their incomparable inferiority to steam as motive fluids.

Claims are now being made in the public press for liquid air as a motive fluid, which are as impossible of attainment and as absurd as anything that has ever appeared in the perpetual motion line, or as multiplier of power.

As explained in my article in The Horseless Age, on "Some Thermo-Dynamics of Vehicle Motors," a motive fluid is a medium for absorbing energy in the form of heat, a portion of which it gives out again in the form of work. It is, in fact, a transmitter of power. The difference between the transmission of power through a crank or lever and through a motive fluid is that the crank is a medium through which mechanical power is applied and given off again in the same form of energy, with loss only by friction, while the best motive fluid known, expanded to do work to the ultimate limit and under the most favorable conditions, can, even theoretically, transmit or give off in the form of work only a little more than one-third of the heat energy absorbed.

In view of the unauthorized use by the Tripler Liquid Air Co. of my name as consulting engineer, in advertisements containing the most absurd claims, I am writing an article for The Horseless Age, which will appear in the next issue, in which I shall show the exact value possessed by liquid air as a motive fluid, and how it compares with steam in economy and cost.

I shall publish simultaneously an article in the Scientific American, in which I shall go into the matter of the application of liquid air to other purposes as well as motive power, and give what I trust will prove to be useful information upon this interesting subject.

Liquid air will have its field and will doubtless prove very valuable for certain purposes, but some of the claims now being made are so fallacious as to be a real menace to the industry, and the actual facts in the case must serve a useful purpose to all concerned. HUDSON MAXIM.

A Change of Heart.

Members of the South Park Board, of Chicago, who a few months ago gave automobiles their first setback and made an unsuccessful effort to keep all electric vehicles off the boulevards of the South Park system, have experienced a change of heart, and are now heartily in favor of horseless carriages, horseless sprinkling carts and horseless wagons of every sort. Automobiles received a great share of the attention of the Commissioners at a recent meeting, and it was decided to purchase motor vehicles for the Superintendent and Captain of Police, in which to make their daily rounds of inspection.

After deciding to get automobiles for these two gentlemen, the Commissioners became so imbued with the "automobile craze" that when a requistion for a new sprinkling cart was read, the advisability of delaying the purchase until bids for an electric cart could be received was considered.

MINOR MENTION.

Buffalo capitalists are organizing the Buffalo Electric Vehicle Co., with $20,000 capital.

An automobile club is to be organized in San Francisco on the lines of the Automobile Club of America.

S. J. Meeker, Ogden St., Newark, N. J., makes a specialty of small gray iron castings for motor vehicles.

James F. Booge, Sioux City, Ia., has asked the city council for a 50-year franchise for a line of public motor vehicles.

E. F. Whitney, Manchester, N. H., inventor of a steam vehicle, is endeavoring to interest Worcester, Mass., capital in its manufacture.

A company with a capital of $25,000 has been organized at Bakersfield, Cal., to operate an automobile line between Bakersfield and Kern City.

Mr. Hartig, of the Hartig Standard Gas Engine Co., 59 Dey St., is interested in the building of a gasoline vehicle at 13 Commercial St., Newark, N. J.

Phineas Jones & Co., 30 Market St., Newark, N. J., have recently received an order for 100 sets of their wood wheels from the Woods Motor Vehicle Co.

Special facilities have recently been added by the Oscar Barnett Foundry Co., 105 Hamilton St., Newark, N. J., for the making of motor cylinder castings.

The St. Louis Motor Carriage Co. have made some very satisfactory tests of the "Auto Sparker," made by the Motsinger Device Mfg. Co., Pendleton, Ind.

The Victoria Motor Vehicle Co., of Indianapolis, $25,000 capital, has been incorporated under Indiana laws by John H. Murphy, Victor and Oscar M. Carman.

The Wilkesbarre Automobile Co. has been organized at Wilkesbarre, Pa., by Edward Gunster, Harry M. Posten and others to introduce public electric vehicles there.

The announcement is made that the General Carriage Co., of New York, has obtained control of a large plant in South Worcester, Mass., for the manufacture of express wagons, how propelled is not stated.

Alexander Winton, one of the representatives of the Automobile Club of America in the Gordon Bennett International Cup Race, will leave for France on May 5, taking with him two racing carriages.

Oscar S. Lear, 201 South High St., Columbus, O., has taken the Columbus agency for the Woods electric vehicles, the "Winner" gasoline runabouts and the Waltham Mfg. Co.'s tricycles and quadricycles.

The New York Automobile Co. has been formed at Syracuse, N. Y., with $350,000 capital, to manufacture motor vehicles. Of the capital stock, $150,000 is 7 per cent cumulative stock, and $200,000 common.

The Safety Steam Automobile Co. is a new Maine corporation capitalized at $1,500,000, of which $50 is paid in. J. F. Warren, Worcester, Mass., is president, and F. W. Damon, Arlington, Mass., treasurer.

The Metallic Rubber Tire Co., 210 Centre St., have had a demand for motor tire covers of their non-slipping pattern, but find that much heavier material will be required to withstand the pressure and weight of the wheels. During the summer they will experiment further in this direction.

The new roller chain which is being introduced by the Baldwin Chain Co., Worcester, Mass., is an example of good workmanship and fine finish. The roller works on a bushing, which is so attached to the inner side link that it cannot work loose. The side links, being chamfered, ride easily on the sprocket. The above features make a strong, smooth-running chain, such as is required for motor vehicles.

The Columbia Motor & Mfg. Co., Washington, D. C., has purchased the plant of the Crouch Automobile Mfg. & Transportation Co., of Baltimore, Md., and will move its Washington plant to Baltimore, which place will in future be the headquarters of the company, although the office in Washington will still be retained. They will manufacture steam vehicles of all styles, with condensers, so that they will not show the exhaust.

The Mobile Co. of America, Kingsland Point on the Hudson, N. Y., complete their first carriage this week, and will soon have the first batch of 50 ready for delivery. Quite a number of improvements have been made, drop forgings having been substituted in many places to secure greater strength and simplicity and minor details having been quite carefully attended to. The carriage follows the general design of the familiar Stanley model.

The Goodyear Tire & Rubber Co., Akron, O., have opened a shop for the repair of their motor vehicle tires at 1557 Broadway, where they desire to have all their tires in service in the East sent for necessary repairs. This department will be run by experienced workmen, and the repair shop at the factory will be continued for Western business. The charges on all tires sent either to the factory or to the New York repair department should be prepaid and the owner's name and address attached.

METROPOLITAN ITEMS.

The Federal Battery Co., 11 Pine St., will shortly bring out a new dry battery.

The Electro Gas Co., 45 Broadway, deal in calcium carbide for all kinds of portable lamps.

Geo. Darby, 153 West 54th St., makes a specialty of storing and caring for electrical carriages.

F. A. Errington, 39 Cortlandt St., has secured a patent on a reversing arrangement for a propeller, the principle of which is also applicable to motor vehicles.

An automobile show is announced to take place in November at the Grand Central Palace. This must not be confounded with the Automobile Club's show, which is to be held in November at the Madison Square Garden.

A. C. Bostwick, a prominent member of the Automobile Club of America, was arrested on Sunday for driving his automobile too fast. Sidney Bowman, a well-known bicycle dealer, was also placed under arrest for running a tricycle in excess of the lawful speed. Both furnished cash bail. E. J. Pennington, of Anglo-American infamy, was also taken in for fast driving.

Doings in Lead Cabdom.

Interesting developments appear to be impending in Boston in connection with the National Transportation Co., which obtained franchises for steam omnibus lines in several of the suburbs, notably Winthrop and Milton, last year. Those franchises were to hold good for a year, lapsing in case the omnibuses had not been started before the middle of the coming summer. All winter the company has been at work on its steam omnibus, but the building of the vehicle has been more or less of an experiment, and there has been a good deal of trouble with it. Just now the gearing, which was too light, is being changed, and the vehicle is being arranged to drive directly on the wheels. But it seems evident that the omnibus cannot be depended on to open both lines where franchises have been secured, and it is understood that the company is considering the advisability of purchasing several electric omnibuses from the Woods Motor Vehicle Co., of Chicago, with which to open up the lines.

This appears more probable from the fact that it is known that the National Transportation Co. has been offered the special agency of the Woods Motor Vehicle Co. for Boston and vicinity, and that if the negotiations go through the National will become virtually an equipment company, to supply not only steam vehicles, but all kinds of electric carriages now catalogued by the Woods Co. It is at the same time negotiating for the Boston agency of the International Power Co., in order to add compressed air vehicles to its list.

The fact that this company is even considering an alliance with the Woods Co. is of considerable interest in Boston, for the reason that the only public motor vehicles now in operation there, and practically all the motor delivery wagons in use are controlled by the rival electric concern, the New England Electric Vehicle Co., which also dominates the Boston Transit Co., the organization which has franchises for lines of electric omnibuses connecting the finer residential sections of the city with the down-town district. The Boston company has been waiting, it says, to secure a type of electric omnibus that will carry 20 persons, and has not talked lately of putting any vehicles in actual operation until the end of another year. All the present electric vehicles for public use must be either hired direct or leased from the local company. Not even delivery wagons are longer sold outright. The Woods Co., if it should establish its agency here, would sell outright.

New York State License Law.

On Friday last a bill to license drivers of steam vehicles in New York State was introduced in the Assembly by Assemblyman Apgar, of Westchester. It provides that no person shall operate a motor without a license, granted by an examining board, to be composed of the persons charged by the local authorities with the inspection of boilers, or passing upon the qualifications of engineers, a fee of one dollar being charged for the examination. This examining board is to examine the persons applying for the license, inspect and test the motor, and if the person is found competent to operate the motor without injury to the public, and if the automobile is found in a safe condition, they shall issue license upon the payment of two dollars for each vehicle. This license shall fully authorize the holder to run and operate the motor carriage upon all public highways, streets, and parks of the State for a period of one year.

The examining board may, upon five days' notice of its intention, revoke or suspend for a period of six months any license issued by it, upon satisfactory proof of the drunkenness, incompetency, or reckless driving of the licensee. Another license may not be issued to a person whose license has been revoked within three months of the revocation.

Any violation of the act is made a misdemeanor, punishable by a fine of not less than $10 nor more than $100.

Barred from Golden Gate Park.

About three months ago the Park Commissioners of Golden Gate Park, San Francisco, made a rule excluding automobiles. Little attention was given to it, as few automobiles are used in that city.

On Washington's Birthday the driver of a Locomobile belonging to the "Examiner" was arrested for a violation of the rule.

An interview with Commissioners Lloyd and Zeile elicited the information that no deviation would be made from the rule, until these carriages became common enough in the city to cease to be a cause of fright to horses. "In course of time," said Mr. Lloyd, "when these vehicles become common on the streets, horses will get accustomed to them, and then they will be allowed in the park. They are not allowed in Central Park, New York, although there are 50 in use there to one here."

"We must protect the ladies and children who throng the park," said Commissioner Zeile. "If these automobiles are allowed in the park, they will cause many accidents."

The Commissioners have since rescinded their rule.

New Road for Automobiles.—Proposed Scenic Highway in New Hampshire.

Governor Rollins, of New Hampshire, Naham J. Bachelder, secretary of the Board of Agriculture of that State, and Dr. John D. Quackenbos, emeritus professor of rhetoric in Columbia, are engaged in the planning and construction of a scenic road, 500 miles long, mostly in New Hampshire. A society is being formed, of which Professor Quackenbos will be president, and as soon as a company has been incorporated stock will be issued. Others who are working for the road are Col. John Hay, Federal Secretary of State; Col. Haskell, of Newton, and Gen. Crufts, of Bethlehem. The Governors of Massachusetts, Connecticut and Vermont have expressed their friendliness toward the project as a benefit to the whole New England mountain country.

"The scenic road," said Professor Quackenbos, "will be an outgrowth of the general movement for good roads in that section. The roads are no worse than those in any other mountainous region in this country, and some of them are away above the average; but it is notorious that few American roads, judged, say, by European standards, comport with our development in other directions. Our road will be a macadamized turnpike, with toll gates at frequent intervals.

"The best macadamized roads cost between $3,500 and $5,000 a mile; we estimate that our 500-mile road will cost $2,000,000. This figure may be exceeded or reduced, according to the extent to which we deem it expedient and consistent to avail ourselves of roadways already laid. We shall probably avoid existing thoroughfares more often than might be imagined, far oftener than ordinary road makers would consider necessary. Roads are usually built nearly in a straight line, but our

road will be unique in that it will have no reference to commercial convenience or economy of time. It will wind in and out of woods and fields, up and down hills and slopes, skirting lakes and crossing streams, and past historic spots.

"Automobiles using it can carry with them provisions, golf clubs, fishing rods, shotguns and what not without impairing the mobility which they share in almost equal measure with the wheelmen. To them the long, scenic road will offer attractions not to be found elsewhere. It is intended mainly for automobiles, bicycles and horses. A New Yorker, with his family, could set out in his automobile to spend his vacation along the scenic road. He would proceed to New Rochelle, Stamford and Bridgeport, through the Berkshire Hills and the Hoosac Mountain, to Bennington, Vt., thence through a gap in the Green Mountains, to Brattleboro, and on to Keene, N. H., tapping the scenic road there.

"The road will start from Boston and proceed diagonally to the Connecticut River, thence up the Connecticut Valley, with a wide curve around the eastern beach of Lake Sunapee, on up almost to the headwaters of the Connecticut, back again past the foot of Mounts Washington and Adams, and through the rest of the White Mountains, along the right shore of Lake Winnipiseogee, across to the sea, through Portsmouth and Gloucester, and so on back to Boston. Thus, the tourist will traverse mountains, forests, lakes, rivers, seashore and settlements."—N. Y. Evening Post.

New Safety Device for Steam Carriages.

The "New Safety Device," illustrated herewith, for cutting off the supply of fuel to the burner when the water in the boiler is too low, was designed by John H. Bickford, mechanical and electrical engineer, of Salem, Mass.

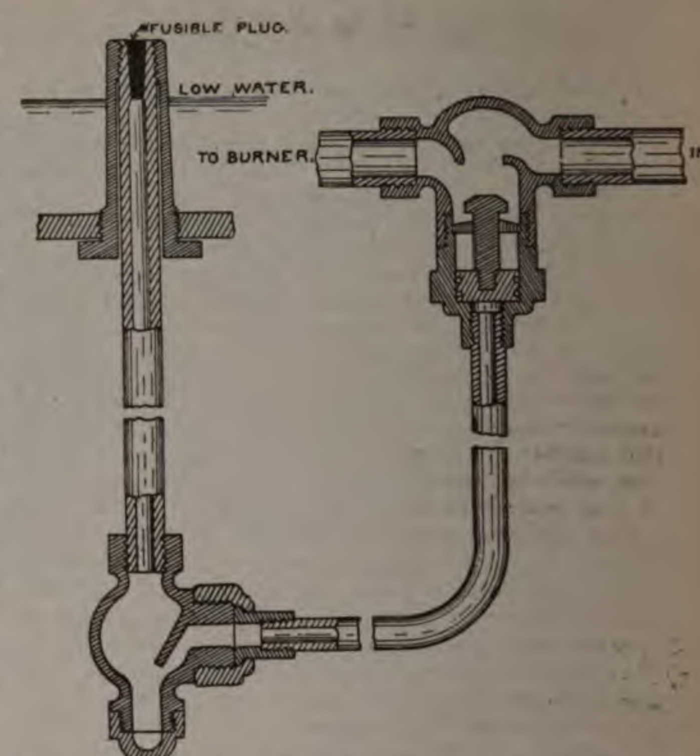
All first-class steam plants have boilers which are supplied with fusible plugs, so located that should the water get low, the consequent rise in temperature causes the metal in the plug to melt, allowing the water to fall upon the fire, thus wholly or partially extinguishing it and preventing explosion.

Mr. Bickford's purpose has been to adapt the fusible plug to the automobile boiler so essentially the same result will take place, in case of low water.

This is accomplished by inserting in the lower head of the boiler a sleeve, the latter projecting upward inside the boiler about 2 in. The upper opening of the sleeve is threaded on a taper and a small pipe, the upper end of which contains fusible metal, is threaded and screwed into the sleeve, the taper thread making a steam tight joint. The lower end of this pipe is connected as shown to a pocket located below the burner. From this pocket a flexible copper pipe leads to a piston valve inserted in the pipe which conveys fuel to the burner. The copper pipe is joined to the pocket by a half union, to facilitate renewal of the pipe holding the fusible metal. All joints are threaded and no packing of any kind is used.

The operation of the device is as follows:—Should the water in the boiler get abnormally low, so as to expose the end of the sleeve, the rise in temperature will be sufficient, before the water can get lower, to fuse the metal, which will fall through the small pipe to the pocket below, while the steam from the boiler will pass along the copper pipe, from the pocket to the piston valve, act upon the piston, close the valve and stop the supply of fuel to the burner.

This has the effect of extinguishing the fire and preventing



explosion. No steam or water escapes to the atmosphere and no damage of any nature will result. The piston valve will return to its normal position as soon as the pressure is relieved, and the plug can be renewed by simply disconnecting the half union, removing the pipe holding the fusible metal and inserting another in its place. The pipe thus removed can be refilled at slight expense and kept as a spare. The fused metal is removed from the pocket by unscrewing the cap at the bottom. A deflecting plate in the pocket prevents the fused metal from falling into the passage to the piston valve.

The illustration is just one-half size of the working apparatus which is made wholly of composition metal, and no part of it will rust or corrode. The inlet and outlet of the piston valve is for ⅛in. standard pipe and if found too large can be easily bushed; or smaller sizes are made to order if desired.

The pipe containing the fusible metal, where it passes between the burner and bottom of the boiler, is protected from the flame by winding it with asbestos or enclosing it in an asbestos sleeve.

When ordering this device, the maximum working pressure of the boiler and the distance from the bottom of boiler to bottom of burner should be stated. Two feet of flexible copper pipe will be furnished with each device unless a different length is specified. The device can be fitted to a boiler by any competent mechanic. The piston valve should not be located near intense heat. Smart & Spencer, Salem, Mass., are the sole agents.

OUR FOREIGN EXCHANGES.

The Pieper Combination Carriage.

A somewhat novel form of automobile vehicle, shown in the accompanying illustrations, is being manufactured by the Société des Etablissements Pieper, of Liege, Belgium, inasmuch as the car is fitted with both a gasoline motor and also a storage battery electric motor. The Pieper Co. state that they have endeavored to construct as light and as simple a carriage as possible, and claim to have succeeded in giving to the assemblage of the driving power an elasticity which the gasoline motor does not possess. To this end they have coupled together a gasoline motor and a dynamo on the same shaft, which by means of a reducing gear of cog wheels drives the rear axle of the car. The dynamo is connected with a small battery of accumulators, the starting of the motor being effected by passing the current of the battery through the dynamo by means of a rheostat, the electric machine, on rotating, dragging with it the gasoline engine. To bring the latter into operation it is then only necessary to regulate the carburetion and the opening or gas admission tap. As soon as this is effected, the dynamo begins to act as a generator, and during a stoppage of the car the power developed by the gasoline engine is transformed into an electrical current, which recharges the batteries. The dynamo is shunt excited, and a rheostat placed in the circuit of the magnetic field enables the speed to be varied considerably. The common shaft of the dynamo and gasoline engine carries a friction clutch, which enables its movement to be transmitted by spur gearing to the rear axle. The dynamo and engine are so connected together that when the car is in motion the former acts as a generator or receptor of electrical energy, according to the power required. If this is less than that of the engine, the surplus goes to the battery; if, on the contrary, it is superior to that which the engine can develop (except at starting or on a steep grade), the speed of the engine lessens and the dynamo receives current from the battery, the power which it gives out

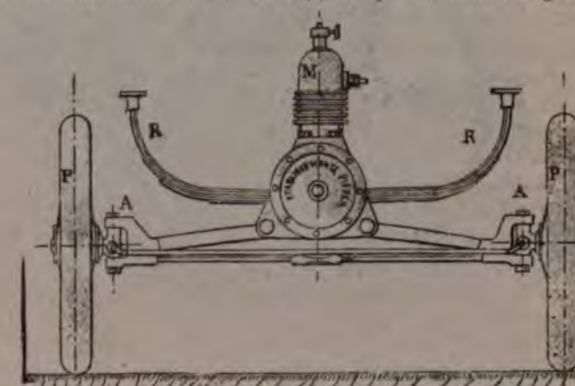


FIG 3.

being added to that of the engine, the whole of the operations being automatically effected. The frame of the car is of tubular construction, the gasoline motor being located in front, the electric motor being at about the center. To insure solidity four stiffening rods are provided, while between the speed-changing shaft and the shaft of the electro motor a flexible couple to facilitate the dismounting of the latter is fitted, while by means of a second coupling the gasoline motor can

THE PIEPER COMBINATION CARRIAGE.

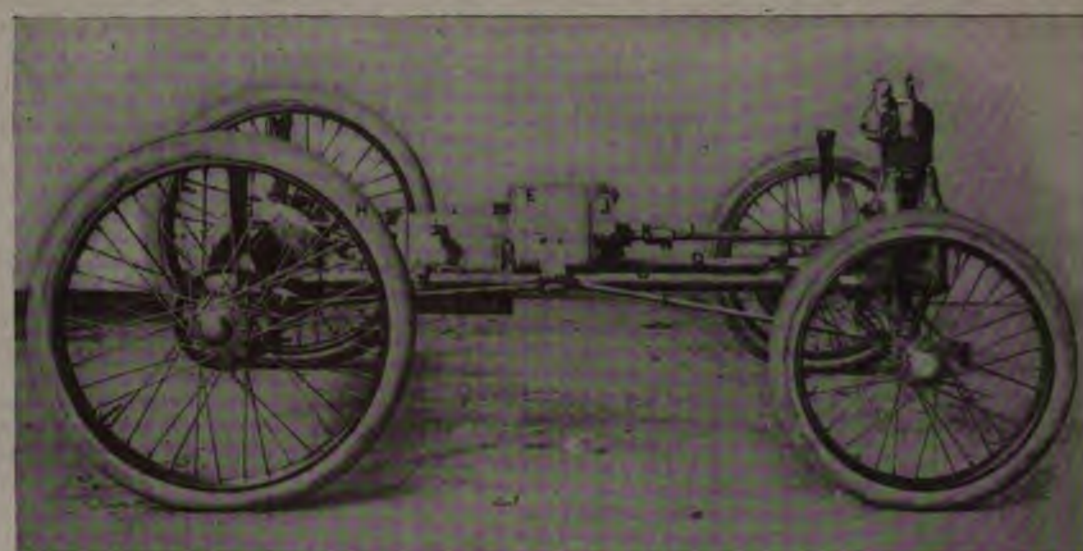


FIG. 2. FRAME AND MECHANISM PIEPER CARRIAGE.

be quickly cut out and the car converted into an ordinary electrical vehicle, the battery and accumulator being of a capacity sufficient for a run of 25 miles on level roads. The power of the engine is so calculated that the battery is slightly charged on flat roads at the maximum speed of the car, the makers stating that in practice the battery always remains charged. Steering is controlled by a hand wheel, while the road wheels are of the cycle type, with pneumatic tires. The battery weighs about 250 lbs. and consists of 40 cells in ebonite boxes. The gasoline motor is of the single-cylinder vertical type, with water-jacketed explosion chamber and electrical ignition. The electro motor is of 2½-h.p. Two brakes are provided, both operated by foot pedals, one acting on the main shaft and one on the hubs of the rear wheels. The car complete weighs about 800 lbs.

The Raymond Carbureter.

A. Raymond ainé of 128 Rue du Bois, Levallois-Perret (Seine), France, has lately brought out a new carbureter of which a general view of a section is illustrated herewith. The main feature of the device is a kind of balanced valve (Fig. 2), which moves on an axis. This valve carries a pointer which engages with the lower end of the gasoline admission pipe z.

The pointer is not seen in Fig 2, it being hidden behind the spindle C of the handle E. A helicoidal cam, C, of which the shaft c is manœuvred externally by means of the lever E, removes the valve V and its axis o more or less from the gasoline inlet pipe, with the result that the degree of engagement of the pointer with the latter is varied. Under the effect of the suction stroke of the engine, the valve V turns on its axis and the pointer falls, allowing a predetermined quantity of gasoline to pass into the carbureting device. As soon as the suction stroke is completed, the valve is brought back to position by a spring, r, the pointer consequently closing the inlet pipe. During the suction stroke, air is also drawn in through the pipe V^1, the mouth A of which is provided with wire gauze to prevent the admission of any dirt or dust. The quantity of

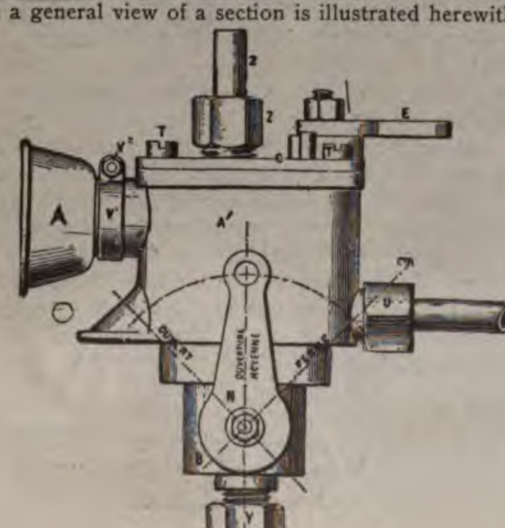


FIG. 1.

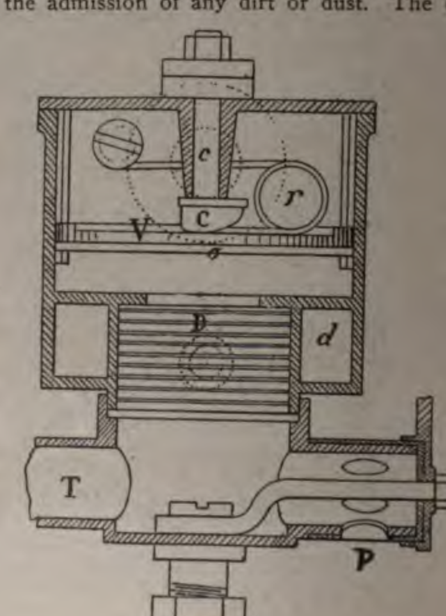


FIG. 2.

air admitted is regulated by the valve V^3. The gasoline, as soon as the valve V moves, falls thereon and meets the air, a thorough mixture being formed during the passage through the series of wire gauze disks D. To assist in the carburetion, a part of the exhaust gases from the engine are made to circulate around the annular space d. The necessary additional cool air to form a good "mixture" is drawn in through the variable valve P, regulated by the handle N, the explosive charge then passing to the motor along the pipe T. To put the motor in operation, the valve V^2 is closed and the handle E moved over about a third of its course, the sparking device being retarded. The engine once in operation, the quality of the mixture is regulated as desired by the levers controlling the valves V^2 E N. The carbureter is being made in several sizes, that illustrated being intended for use on small motors of from 1 to 2 h.p. It is claimed that the device, while occupying small space, is regular in its action, notwithstanding the jolting caused by uneven roads, and that the regulating valves are instantaneous in their action.

A New Steam Omnibus.

The accompanying illustration gives a general view of a steam omnibus which has lately been built by La Compagnie National des Courriers Automobiles, of 22 Rue Rossini, Paris. The vehicle is propelled by a two-cylinder engine of 14-h.p., steam for which is supplied by an explosible tubular boiler of the Thirion type. The engines are located under the floor of the car in such a way that each of the cylinders actuates one of the rear road wheels through chain gearing. Steering is controlled by a vertical hand wheel, while three brakes are at the command of the driver. The water tank has a capacity of 300 liters, said to be sufficient for a run of 30 kilometers. The wheels are of wood, shod with iron tires. The 'bus, which has accommodation for 14 passengers, driver and 1,340 lbs. of luggage or goods, weighs 6,160 lbs.

The Tourand Carriage.

La Locomotion Automobile, in a recent issue, gives a description of a new gasoline carriage built by Tourand & Co., of Havre, France.

It is propelled by a two-cylinder Crozet motor of 6-h.p., said to be so constructed that on the higher speeds no disagreeable vibration is experienced, and having but one exhaust and one inlet valve. All parts of the motor are encased and run in oil. The carbureter is automatic and is not affected by changes of temperature. Ignition is electric and transmission is effected by a patented system of gears always in mesh and operating the differential shaft. The four speeds forward and back are controlled by a single lever. The frame is of section steel riveted firmly together by bolts and screws securely locked to prevent loss. There are two brakes, one on the countershaft, operated by a pedal, and the other for an emergency, acting on the hubs of the hind wheels. A drop stick prevents accident on hills in case of derangement of the

FRENCH STEAM OMNIBUS.

THE TOURAND GASOLINE CARRIAGE.

machinery. The motor requires but one oil cup, and all the bearings of the vehicle are automatically lubricated.

The wooden wheels have metallic hubs and Michelin pneumatics.

The weight of the carriage, with all supplies on, is about 1,500 lbs.

Anglo-American Shares in the London Market.

In our issues of December 8 and 9 we warned our readers that there was a rig on in British Motor shares. They were then working up to 18s. per share. To-day they are practically unsalable at 6s. per share, which is the nominal quotation. Mr. Harry J. Lawson went to the United States, we believe, to sell the company's patents, and upon his return various sensational reports were spread abroad as to the success of his mission. The rumor that there is to be a motor trust may be regarded as being purely problematical; in fact, impossible. Those who spread these various rumors have, of course, an object to gain, and it will be well that any one intending to invest in British Motor shares should leave them severely alone. The discussion which is going on in city circles as to the purchase of Mr. Lawson's interest in this concern has nothing to do with the intrinsic merits of the shares. They are sufficiently worthless to be left in the hands of those who now possess them.—London Globe.

A New Aster Gasoline Motor.

Now that light two-seated voiturettes have become so popular in France, constructors of such vehicles are finding that the air-cooled motors at first adopted are not proving satisfactory. The result is that De Dion & Bouton are making a 3-h.p. water-cooled motor, and their example has been followed by Les Ateliers de Construction Mecaniques L'Aster, of St. Denis (Seine), France.

ASTER MOTOR WITH WATER JACKET.

The Aster air-cooled motor with its radial disks of corrugated copper is already well known. The new water-jacketed engine which is illustrated here is capable of indicating up to 3 h.p.; in other respects it is similar to the air-cooled motor above alluded to.

The Partin Motor.

In this motor, which works on the Otto cycle, using petrol as fuel, there are some features in the design of considerable interest, and which are in the direction of general improvement. The arrangement of the valve chest permits the rapid examination and removal of the valves without interfering with the pipe flanges. The most important feature, however, is the governor gear, by which automatic regulation is obtained. Upon one of the crank webs, M^1 (see Fig. 2), is a lug carrying the bent lever, T, one end of which terminates in a heavy weight, and the other rests upon a spindle, U, passing axially through the main shaft and free to move in an axial direction. Such movement displaces the finger, U^1, which

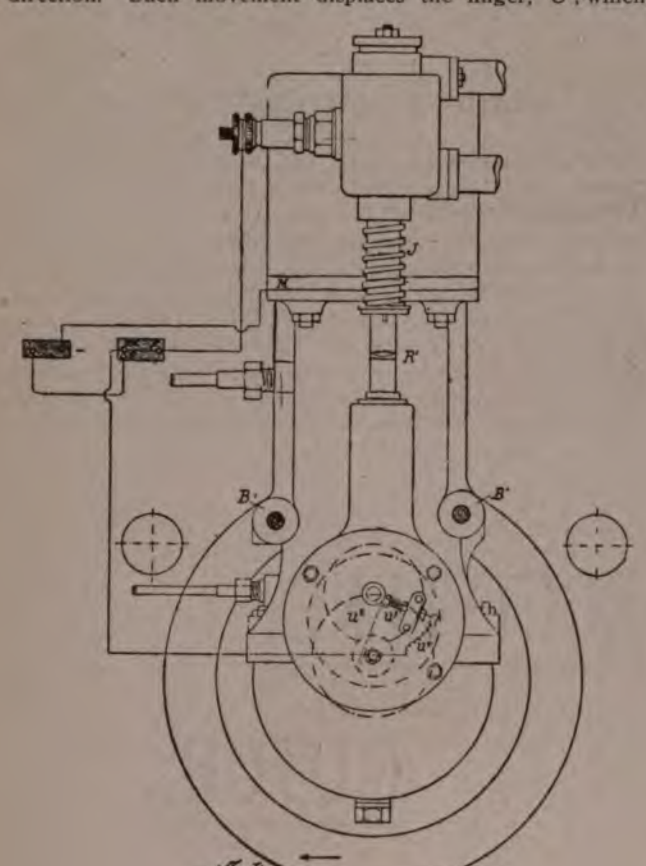


FIG. 1.

makes contact with the ignition cam, S. This cam has a diagonal groove of 45 degrees, in which the point of the finger, U^1, is engaged once every revolution. It follows that the point of contact varies with the position of the lever, U^1, with respect to the groove on S. Should the speed of the motor alter, the centrifugal action of the weight at T alters the position of the spindle, U. If the speed increase at the instant of completing the circuit through the trembler, U^2, the contact points, U^3, with S is delayed, hence the ignition spark is also delayed.

Referring to the drawings:

A is the casing forming the crank chamber.
B, B^1, the bolts attaching the motor cylinder to the casing.
C, the jacketed cylinder.
E, the water space.

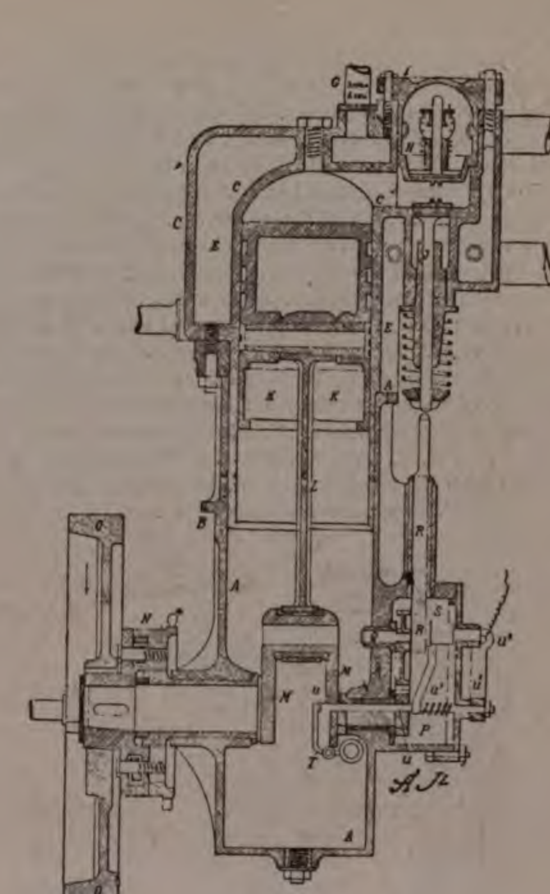


FIG. 2.

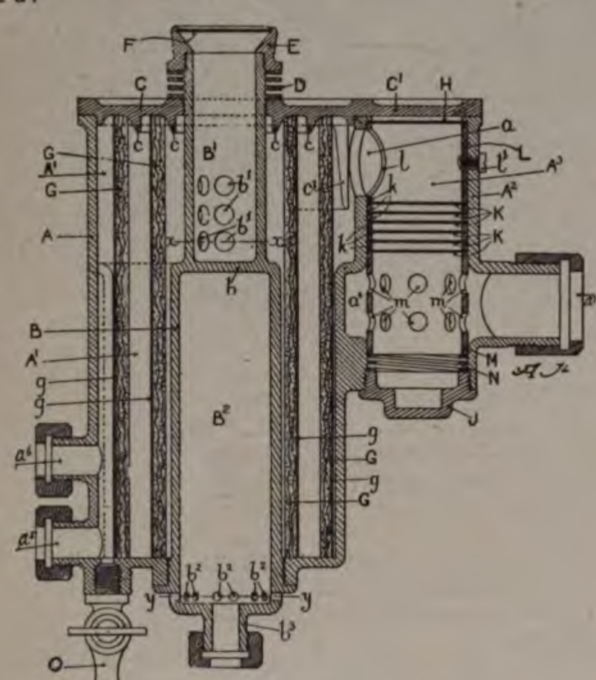
F, water supply pipe.
G, water outlet pipe.
H, suction or inhaust valve.
I, suction valve chest cover.
J, exhaust valve.
K, piston.
L, piston or connecting rod.
M, M^1, crank cheeks.
N, starting gear.
O, fly wheel.
P, pinion gearing, with pinion on cam shaft, Q.
R, cam actuating exhaust valve rod, R^1.
S, ignition cam.
T, governor.
U, spindle carrying ignition finger and trembler.
U^1, ignition finger.
U^2, trembler.
U^3, contact points.
U^4, insulated wire.
V, ignition or sparking tube in cylinder.—The Automotor.

The Parsons Carbureter.

The Parsons carbureter is the invention of H. Parsons, of Earlsdon, Coventry. As will be seen, it consists of two cylinders, A and B, mounted concentrically one within the other, the upper ends of each being enlarged and reduced respectively, forming the annular carbureting chamber, A^1. The inner cylinder, B, has an internal web or diaphragm, b, separating it into two chambers, B^1 and B^2. In the upper chamber, B^1, are a series of small holes, b^1, b^1, etc., putting it into com-

munication with the carbureting chamber, A^1. The lower end of the chamber, B^2, is in communication with the atmosphere by a series of small holes, b^2, b^2, etc. The lower end of the cylinder, B, is fitted with a nozzle, b^3, for the attachment of a pipe leading from the exhaust, so as to heat it. The upper end of the cylinder, A, is fitted with a rotating cap, C, held in place by the spring, D, and the screw cap, E, in which latter is a gauze screen, F. Within the chamber, A^1, are one or more cylinders, G, of porous woven fabric, such as lamp wick.

On the side of the cylinder, A, is a smaller one forming the mixing chamber, A^2, the upper end of which is in communication with A by means of an orifice, a, the opening of which can be regulated by turning the cap, C; this regulates the amount of vapor passing from the carbureting chamber, A^1, to the mixing chamber, A^2. To the upper end of A^2 is a gauze cap, H. To the lower part of A^2 is a nozzle, a^3, in connection with the suction valve of the motor by a pipe, the lower part of A^2, opposite the nozzle, is recessed as shown at a^4.



THE PARSONS CARBURETER.

Between this annular recess, a^4, and the opening, a, leading into the carbureting chamber, A^1, is a safety screen, which consists of a series of gauze disks, K, K, etc., kept apart by a series of rings or washers, k, interposed between them. Beneath the safety screen is a cylindrical distance piece, M, which extends over the recess, a^4, and converts it into an annular chamber. In this distance piece, M, are a series of small holes, m, m, etc., which put the interior of the cylinder into communication with the annular chamber formed by the recess, a^4, by which the explosive mixture of spirit vapor and air passes to the nozzle, a^3, the holes, m, m, etc., insuring the effective mixture of the spirit vapor and air. Between the bottom of the cylindrical distance piece, M, and the screw cap, J, is a spiral spring, N, which acts to keep the several parts together, and facilitates their being placed in position after removal for cleansing or other purposes.

The upper end of the cylinder, A^2, is closed by means of a continuation, C^1, of the can or plate, C, and as this plate rotates about the center of the cylinder, A, it will be seen that its rotation in one direction or the other causes the part, C^1, to uncover or close the top end of the cylinder, A^2, thereby acting as a valve to control the supply of air to the mixing chamber, the part, C^1, of the cap or plate being so proportioned that the chamber, A^2, is opened to the atmosphere as it is being closed to the carbureting chamber, and vice versa, as it is closed to the atmosphere it is opened to the carbureting chamber.

At the botom part of the cylinder, A, is a nozzle, a^5, for connecting it with the oil or spirit tank, which may be in direct communication with the cylinder so long as its depth does not exceed the depth of the smaller part of the carbureting chamber, A^1, so that the height of the oil in the carbureter cannot rise higher than the diaphragm or web between the two chambers, B^1 and B^2, of the inner cylinder, B.—The Automotor.

Death of Gottfried Daimler.

Cable dispatches announce the death at Cannstatt, near Wurtemberg, Germany, of Gottfried Daimler, the "Father of Automobilism," "Papa" Daimler as he was called in Paris. He was many years ago engaged with Doctor Otto in perfecting the well-known Otto gas engine, and later evolved the motor bearing his name, which was immediately taken up by the French pioneers in Automobilism, Emil Levassor and the Peugeots. He was the founder of and was largely interested in the Daimler Motor Company of Cannstatt. As the prophet of the new era in road locomotion he was revered in all the chief centres of the Old World, where Automobilism had found its devotees. He was 66 years of age.

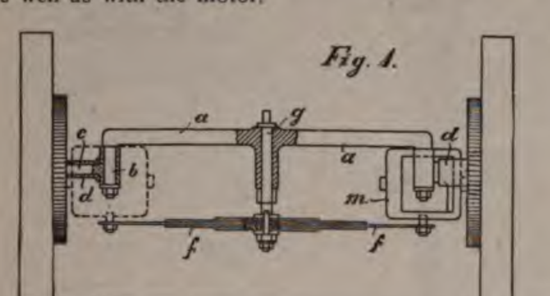
MOTOR VEHICLE PATENTS of the world

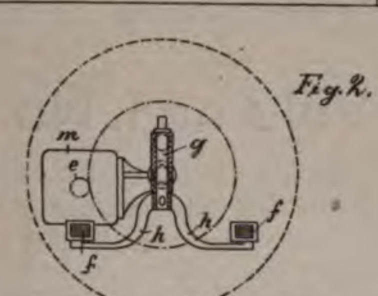
UNITED STATES PATENTS.

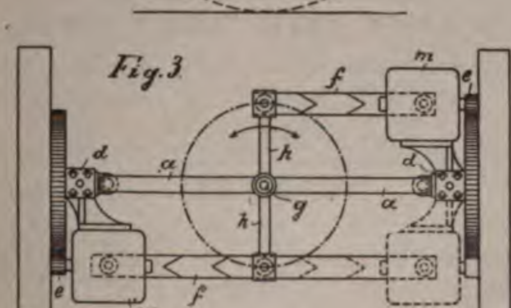
No. 644,225—Motor Car.—Hans Joachim Elsner, Kalk, Germany. Application filed Dec. 2, 1899.

Fig. 1 shows the arrangement of the motor in elevation. Fig. 2 is the corresponding side elevation. Fig. 3 is a plan of the same.

The axle a, fixed upon the frame of the car, possesses the revolving pivots b, bent around at right angles, upon which the axle shafts c, bearing the steering wheels, can revolve. The gear wheel e, located on the axle of the motor m, engages with the toothed wheel attached to each steering wheel. A bearing, d, fastened to the motor, engages around the rotary axle shaft c, so that the distance of the motor remains always the same and the rotary axle shaft must follow the movements of the motor. The motor itself is supported by means of a spring, f, from the arm h, revoluble around the vertical shaft g. The spring f is attached at or near the center of gravity of the motor and is pivotally connected with the arm h as well as with the motor.





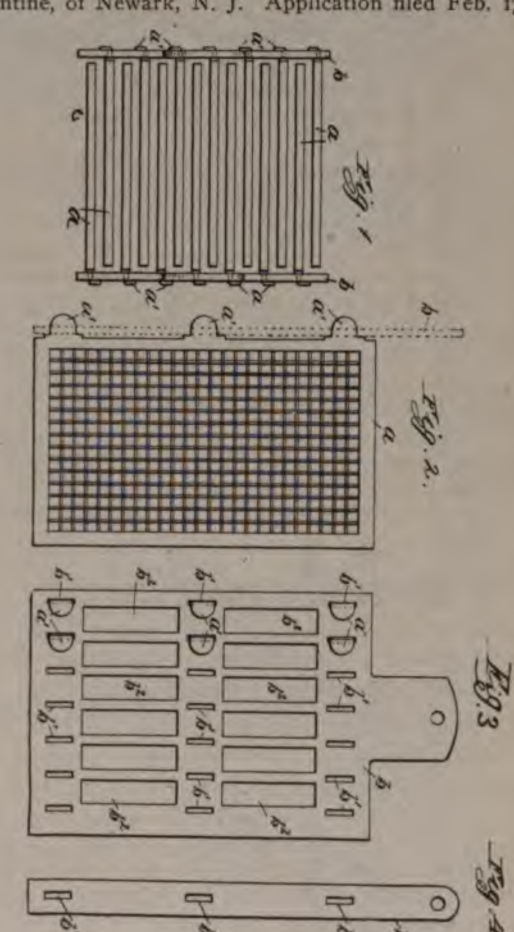


Instead of arranging both motors at different sides of the axis a, they may be arranged at the same side of said axis, as shown in Fig. 3 by dotted lines.

By means of the arrangement described it is attained that, on the one hand, all jolts caused by the motors and their movements are directly transmitted to the fixed axle, and consequently there is no strain on the axle shafts, and that, on the other hand, the car can be steered directly by means of a corresponding movement of the lever. If the lever b is turned in either direction around the vertical shaft g, this movement will cause the motors m to turn around the center of rotation of the corresponding axle shaft on account of the bearings d encircling the rotary axle shaft c. Thus the steering wheels are turned in the required manner without altering their parallel position with regard to one another or the engagement of the gear wheels.

By means of this invention the wheels are able to turn about 180 degs., and the car can be turned around within the space it stands upon, if any of the usual means for overcoming the dead point are made use of.

No. 644,144—Connecting Plate for Storage Batteries.—Harry E. Osburn, of Chicago, Ill., assignor to J. Herbert Ballantine, of Newark, N. J. Application filed Feb. 17, 1899.



It has been the usual practice heretofore to provide at the upper edge of the battery plate, usually at one corner, a neck or strip of metal usually formed integral with the metal of the plate to serve as a terminal, the terminals of the several plates of one polarity being united electrically by a conducting rod or wire joined to each of the terminals. This structure is

more or less objectionable in practice, first, due to the fact that the neck of metal corrodes and disintegrates at the acid line—that is, at the surface of the electrolyte—and in consequence becomes eaten away in time to such an extent as to affect the efficiency and operation of the cell, and, second, due to the fact that the current is supplied only at one corner of the plate, and in consequence the active material begins to form first in the vicinity of the neck, the forming process gradually progressing outward to the remote portions of the plate, and likewise, during discharge, the plate first discharges in the vicinity of the neck or terminal. In this manner one portion of the plate becomes overworked and is worn out when other portions of the plate are still in good condition.

It is the object of this invention to obviate the above objections by providing a terminal plate united with one or more of the battery plates below the acid line by a plurality of connections, whereby the current, instead of being supplied to the plate at one point, is uniformly distributed over the battery plates to thereby increase the efficiency and duration of the cell. Furthermore, the cost of construction is by this invention claimed to be materially decreased, and a more stable structure results.

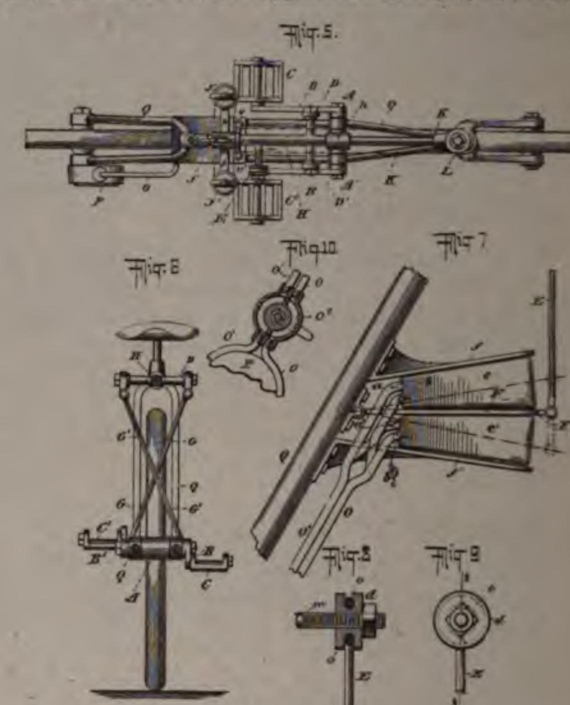
In the preferred form the inventor provides a single connecting plate for each pole of the cell, to which all of the plates of one polarity are connected, each battery plate being connected with the connecting plate by a plurality of lugs or paths.

Fig. 1 is a plan view of a storage battery. Fig. 2 is a view in elevation of one of the battery plates. Fig. 3 is a view of the connecting plate. Fig 4 is a view of a modification.

Each of the battery plates a is provided with a plurality of tongues or lugs, a′ a′ a′, at one edge, and the connecting plate b is provided with a series of openings, b′ b′ b′, through which the tongues a′ are adapted to pass, the ends of the tongues being bent over and secured to the face of the connecting plate by burning or by soldering. The material of the connecting plate b is removed at intermediate positions, to leave a series of openings, b^2 b^2, thereby dispensing with superfluous material and rendering the weight of the connecting plate a minimum. Two connecting plates, b b, are provided for each cell, all of the battery plates of one polarity being connected with one of the connecting plates, while the battery plates of the opposite polarity are connected with the other connecting plate. Instead of providing a single connecting plate, one connecting plate may be provided for each of the battery plates, as illustrated in Fig. 4, and the several connecting plates may then be joined together in any suitable manner, preferably one connecting plate for all of the battery plates of one polarity, as shown in Figs. 1 and 3.

The upper portion of the connecting plate joined to the several battery plates is extended upward to form the terminal of the cell, thus doing away with the many joints heretofore employed for connecting the terminals of the several plates with the terminal of the cell.

No. 644,113—Propulsion of Vehicles.—Walter H. Underwood, New York, N. Y. Application filed July 17, 1895.



SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

THE JUMP SPARK LEADS
Give Thick
1 Inch Jump Spark.
Weight, 8 lbs.
Dimensions, 8 x 4 x 4 ins.
Patent Applied For.

C. F. SPLITDORF, ELECTRICAL SPECIALTIES,
21 Vandewater St., New York.

GASOLINE ENGINE CASTINGS.

One to four h. p., for stationary marine or vehicles; rough or partly finished. Also complete engines, carbureters and accessories. LOWELL MODEL CO., Box 292, Lowell, Mass.

FOR SALE.

Motor Phaeton. Winton System. The best on the market without exception. I have two, both alike; in perfect condition, and good as new. Can take your choice. Address,

B. O., care of HORSELESS AGE.

SPECIAL *TURNED METAL PARTS FOR AUTOMOBILES. Made to order from sketch or sample.* : : : : : : : : : :

DODGE MACHINE SCREW CO., BOSTON.

FOR SALE.

Winton phaeton, new, only run enough to put it in good running order. One of the quietest and fastest made by this company. Owner wishes to get a two-seated carriage. Address F. W. H.,
Care of HORSELESS AGE.

STEAM VEHICLE FITTINGS.

PIN Valves (both union and plain ends), Injectors, Gasoline Regulators (improved type), Water Regulators, Improved Glass Gauges, Globe and Check Valves, Water Relief Valves for Cylinders, Steam Gauges and Safety Valves.

LOCKE REGULATOR CO., - - Salem, Mass.

ELECTRIC IGNITION

IN GAS, GASOLINE AND OIL ENGINES.

We make special SPARKING POINTS for this service possessing extreme hardness and greater durability than platinum.

SEND FOR DESCRIPTIVE MATTER AND PRICES.

BAKER & CO., Manufacturers of Platinum Products, **NEWARK, N. J.**

OPENING FOR AMERICAN AUTOMOBILES IN FRANCE.

An American, thirty-five years of age, having resided three years in Paris and in France where he has most successfully introduced an American article closely identified with Automobiles, is open for engagement for representation of a good petroleum motor. Party in question speaks the French as fluently as English and is in close touch with the trade daily. Representation of a high-grade motor and a first-class house only desired. Best references Paris and New York given.

X. Y. Z., care HORSELESS AGE.

Seamless Cold Drawn Steel Tubing, Shells, Cylinders and Tanks, For Air, Gas, Steam, Ammonia or fluids under pressure and explosives. ☞ Seamless Steel Tested Tanks of Sundry Diameters.

DROP FORGINGS AND STEEL STAMPINGS.

JANNEY, STEINMETZ & CO., Drexel Building, Philadelphia, Pa.

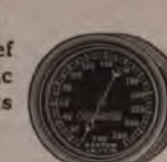
FOR SALE.

A second-hand Winton phaeton; just from the works, in perfect running order; will give trial Only selling to purchase another carriage of same make, but with more power, to use in another part of the country where roads are heavy and grades steep. Price $750. Apply Adams, No. 57 West 66th Street.

...ASHTON...

Pop Safety Valves, Cylinder Relief Valves, Steam Gauges, Automatic Water Gauges and Gauge Cocks for

STEAM VEHICLES.



THE ASHTON VALVE CO., 271 Franklin St., Boston, Mass.

BRANCHES: 121 Liberty Street, New York. 1218 Filbert Street, Philadelphia. 218 Lake Street, Chicago, Ill.

Automobile Storage and Repair Co.

Station No. 1—57 WEST 66th STREET (St. Nicholas Rink Bldg.), NEW YORK.

House and Care for Automobiles of all kinds. Storage Batteries Charged and Supplies of all kinds furnished.

Transients Accommodated.

AUTOMOBILE CHAINS....

We are prepared to furnish Automobile Chains suitable for all demands of the trade. Send for Catalogue.

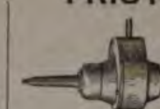
Baldwin Detachable Chain Co.,
Worcester, Mass., U. S. A.

WANTED.

A manufacturer to make my gasoline motor carriage. It is very simple, strong and cheap to construct. Vibration practically overcome. No machinery in sight. Sole right for sale or will lease on royalty.

Address M. E., care of HORSELESS AGE.

FRICTION-LOCK



REVERSE GEAR FOR AUTOMOBILES AND LAUNCHES.

Patent for sale. Apply **F. A. ERRINGTON,**
39 CORTLANDT STREET, NEW YORK.

WANTED.

Steam Automobile. Give make, age, condition and price.

Address "Steam,"
Care of HORSELESS AGE.

VALUABLE PATENT RIGHTS AND DESIGNS For Automobile and Boat Engines and Running Gears and . . . . Accessories for Automobiles . . FOR SALE.

AT A REASONABLE PRICE FOR ENGLAND, GERMANY AND FRANCE, SINGLY OR TOGETHER.

THIS is not a scheme to unload undesirable property but is an honest and legitimate offer; because the party desiring to make the sale feels that the American field is amply sufficient in which to operate himself. Close and Business-like **Investigation is Solicited,** and no letters will be answered that are not accompanied by references in regard to character and financial standing, which can be quickly investigated from New York City without prolonged correspondence. It is desired to get in touch with manufacturers of standing, or reliable and responsible capitalists who wish to embark in this line of work.

ADDRESS—"K," CARE OF THE HORSELESS AGE COR. NASSAU AND SPRUCE STS., NEW YORK CITY, U. S. A.

VOLUME FOUR COMPLETE.

(April 5th to September 27th, 1899, inclusive.)

To New Subscribers for Two Years.

We wish to place these volumes in the hands of persons permanently interested and therefore offer them only to those who will subscribe for two years from April 5th, 1899. :: :: ::

SEND $4 AND GET THIS VOLUME BEFORE IT IS EXHAUSTED.

A Machine is Only as Strong as its Weakest Part. A Gas Engine is Reliable Only so Far as the Prompt Ignition of its Charge is Assured. . . . .

THE H-C DYNAMO IGNITER

with permanent magnet fields **WILL POSITIVELY DO THIS** work. If you are tired of expense and annoyance of batteries, send for our descriptive pamphlet and investigate. It will surely repay you.

SPECIAL DESIGNS FOR AUTOMOBILE USE.

THE HOLTZER-CABOT ELECTRIC CO.,

NEW YORK. BOSTON (BROOKLINE), MASS. CHICAGO.


Round
the
World
the
Kelly-Springfield Tire
wins its way. The only successful Rubber Tire in the world for vehicles. The genuine has "Rubber Tire Wheel Co." moulded in the rubber. Put on any vehicle by best carriage makers and dealers everywhere.

ANGLO-AMERICAN STOCK JOBBERS.

SOMETHING about the London History of Pennington and Lawson Leaders of the 75,000,000 Dollar American Promoting Expedition.

ISSUE OF FEBRUARY 7TH.

10 Cents, Stamps or Coin.

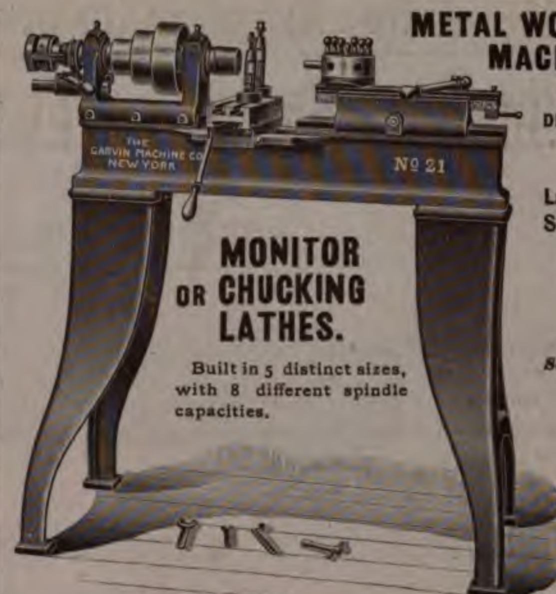
THE HORSELESS AGE
150 NASSAU STREET,
NEW YORK

Volume I, No. 1.

PARTIES having copies of the November, 1895, number of THE HORSELESS AGE, which they are willing to sell or exchange for later numbers, are requested to communicate with the publisher.

CAN YOU GET US NEW SUBSCRIBERS?

Any of our subscribers who are willing to solicit subscriptions for THE HORSELESS AGE from their fellow townsmen, are requested to communicate with the Editor.



METAL WORKING MACHINERY OF EVERY DESCRIPTION

Large Stock.

Quick Delivery.

Send for Catalog.

No. 21 Monitor or Chucking Lathe.

The Garvin Machine Co.,
Spring and Varick Streets,
NEW YORK...

SALES AGENTS:
Philadelphia: The Garvin Machine Co., 51 N. 7th St.
Chicago: Manning, Maxwell & Moore, 22 S. Canal St.
Berlin: Deutsche Garvin Maschinen-Fabrik, A. G., 17 Burg Strasse, Berlin C., Germany.
London: C. W. Burton, Griffiths & Co., Ludgate Square, Ludgate Hill, London, E. C., England.
Paris: Montgomery & Co., 28 Boulevard Magenta, Paris, France.

WANTED.—*Vol. 1, No. 1, Vol. 2, Nos. 5, 6, 7, 8, 9, 10, and Vol. 3, No. 1.* A new number of the weekly will be given in exchange for any one of these, *if in good condition*, and for Vol. 1, No. 1, four numbers will be given if in good condition. HORSELESS AGE, American Tract Society Building, Nassau and Spruce Streets, New York.

IN YOUR TOWN, FROM YOUR FRIENDS,

will you solicit subscriptions for THE HORSELESS AGE on a commission basis? If so, write the Editor.

HYDRO-CARBON SYSTEM.

SOMETHING NEW

A Motor Vehicle With Space in Back for Carrying Packages, Etc.

If you desire the **simplest, most easily understood** and **managed** motor vehicle ever offered, write

ST. LOUIS MOTOR CARRIAGE CO.,

MANUFACTURERS OF COMPLETE VEHICLES ONLY. **St. Louis, Mo., U. S. A.**

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. V. NEW YORK, MARCH 14, 1900. No. 24.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

Removal.

To secure more room we have moved our office from the sixth to the thirteenth floor of the American Tract Society Building, where our advertisers and subscribers are invited to call.

Good Roads.

Civilization depends on roads. Where there are no roads there is no civilization, and just in proportion to the number and excellence of roads does it flourish and extend. Barbarians have no roads. They are isolated and contented with their narrow environment. But with the spirit of conquest and discovery comes the beaten track, the blazoned way, which may serve the traveler or trader as a guide in going from place to place. As traffic increases a better and more permanent roadbed is demanded. This is the history of the modern road. Rome, as her empire grew, projected from the Eternal City roads as eternal, reaching to her remotest provinces and distributing to them the benefits of her civilization. To-day, centuries after the disintegration of the Roman Empire, these military roads constitute the main avenues of communication between many of the principal European centers. So far-reaching have been their consequences that if we should undertake to follow them we should find ourselves in constant touch with the commerce, recreation and social life of ancient, mediæval and modern Europe. It is true in more than one sense that all roads lead to Rome, for to the splendid object lesson afforded by these Roman roads the leading nations of the Continent are in large measure indebted for the excellent systems of roads which have been modeled after them and which are to-day the envy of American motorists.

Measured by its common roads the standard of civilization in the United States would not be flattering to our national pride. To our railroads we must appeal if we would gain an adequate idea of our greatness. In the mileage and general equipment of these main arteries of traffic we are in advance of Europe for reasons which must be obvious to every observer. Our country is new and vast. It was settled by civilized races possessing the arts and imbued with the spirit of enterprise and material progress. It was necessary for the development of its resources that main lines of communication should first be established. With characteristic energy we have bent ourselves to this task, and the common roads, the natural feeders of the railway systems, have been lost sight of. We have built splendid railways—the admiration of the world—and now that our needs in this respect are well supplied, let us turn our attention to the highways and build roads that shall be as creditable as our railways. In fact, good roads are essential to the further development of the railways. Both freight and passenger traffic are dependent in no small degree on the condition of the roads. Produce will be more easily and cheaply hauled to the shipping points and from depots to consumers, agricultural sections now desolate will become tillable, suburban residence will be more

desirable, and the comforts and amenities of life will be augmented when roads are improved. Bad roads put a ban on husbandry and exchange, and cramp and embrute the whole life of man. They are the sorriest advertisement a community can have, and from this time forth they will be due to inexcusable negligence, inasmuch as the gospel of good roads is being preached in the land.

The subject of roads is too broad to be adequately summarized in any space short of a small volume, and we shall content ourselves with these few general reflections and pass on to the bearing of good roads on the motor vehicle industry.

The relation of good roads to the motor vehicle industry is a vital one. They are interdependent. No machine, however well constructed, can take the punishment of average American roads without excessive rack and strain, and, consequently, relatively short life and heavy repairs. The greater the number of parts—particularly moving parts—in a road vehicle the greater the damage done by road vibrations and strains. For the motor vehicle, therefore, good roads are more necessary than for the horse vehicle on the grounds above mentioned, and for the attainment of higher speed, which is rightly expected from the motor. In Europe the motor has given a great impetus to touring, and will no doubt do so here when our roads are in such condition as to make it enjoyable.

Prospects for good roads are brightening. Makers and users of motor vehicles are beginning to make their influence felt in the cause of good roads. They realize the importance of them and have started an agitation which is destined to spread over the entire country and enlist a new force more potent than any of the agencies now working for this end. The Automobile Club of America started the new propaganda several weeks ago at a special good roads meeting held at the Waldorf-Astoria, when prominent leaders of the movement delivered addresses. These addresses have been compiled by the club and issued in a pamphlet entitled "A Plea for Good Roads," extracts from which we print on another page of this issue. It contains a great deal of encouraging statistics and practical data on the subject of road improvement, and we strongly urge all friends of the new vehicle throughout the United States to send to the club for a copy of this pamphlet and make use of it in disseminating information on good roads and in arousing public sentiment therefor in their respective localities. The chairman of the good roads committee is Albert R. Shattuck, who may be addressed in care of the club, Waldorf-Astoria, New York.

A "Hydraulic Burst."

An example of a "hydraulic burst," such as the Autotruck promoters referred to when they were floating their compressed air vehicle companies, was afforded at the sheds of the crosstown line of the Metropolitan Traction Co. at Twenty-fourth St. and North River on Saturday. A compressed air tank on one of the cars was defective or had been overcharged, and burst with a terrible roar, demolishing the car and injuring several men who were nearby. Air confined under 1,500 to 2,000 lbs. pressure and suddenly released is not the gentle lamb the Autotruck promoters represented it to be. It obeys the laws of the expansion of gases, just as any other gas does, and returns to its natural atmospheric form at once, without regard to consequences.

Responsibility of the Horse Owner.

We referred in our last issue to the plan adopted by a prominent member of the Automobile Club, of educating the horses of his fellow townsmen to the automobile by advertising in the local papers his willingness to bring his automobile to the stables of those who wished their horses broken, and, upon request, taking his machine himself to the neighbor's stable and putting the horses through a course of education. The idea is an admirable one, and in the event of a fellow townsman's horse taking fright at his automobile, raises interesting questions as to the legal responsibility of one who has pursued this policy. It is generally conceded that the motor vehicle has a right to the public highways and that the motorist is bound by the same rules of the road as govern the driver of animals, the unwritten law of courtesy further requiring that he should exercise all reasonable caution to avoid accidents due to the frightening of horses. But if the above statements are true, and it is admitted that the motor vehicle is a fact—a necessary concomitant of our advancing civilization—then an equal responsibility rests upon the owner of a horse which is driven through the streets, to take all reasonable precautions to avert accident through his horse taking fright at a motor vehicle. Consequently, we hold that in places where owners of automobiles follow the example cited above and publicly advertise their willingness to break their neighbors' horses to the automobile, the burden of responsibility for accidents caused by horses taking fright at these machines is shifted to the owners of the horses, unless it can be shown that the motorist was guilty of misconduct. The horse owner who fails to take advantage of this opportunity to safeguard himself and his fellow citizens is guilty of contributory negligence.

The New York License Bill.

We reprint in full the bill to regulate the running of motor vehicles in New York State, which was introduced in the Assembly recently by Mr. Apgar, of Westchester County. The bill is so mild and pacific in character that it is difficult

to find any objection to it. Expert abilities are not required of licensees, and the duty of inspecting the vehicles and deciding the competence of the drivers is lodged with the present inspectors of steam boilers or examiners of engineers or those who may be appointed to act in that capacity in the various cities, counties and towns throughout the State. The fee is nominal, and on the whole the regulation of motor traffic in this manner, if judiciously administered, may serve as a needed restraint in some cases and correct abuses that would otherwise go unchecked. While the whole subject of protective vehicle legislation is being discussed, however, it is pertinent to inquire why, if motor vehicle drivers are to be compelled to take out licenses, those who daily send out into the streets incompetent drivers or uncontrollable horses to endanger the lives of their fellow citizens should not be held to a stricter accountability. Is an old and aggravated offense less punishable than a new one anticipated and in all probability overdrawn?

Alcohol Motors.

In the Acetylene Number, to be issued in May, we shall also consider the availability of alcohol as a fuel for vehicle motors. It is well known that alcohol is a poor fuel as compared with gasoline or kerosene, and that its economical use in motors would only be possible if the price of gasoline were raised to the point of extortion or its supply should fail and the tax on alcohol now levied by the Government were abolished. Still, we shall endeavor to present some interesting facts in regard to this fuel.

Honor to Whom Honor is Due.

More honor to the Honorable J. Scott Montagu, M. P.! He told the truth. The motor trade of Great Britain had waited and suffered long, but now that the silence is broken and Lawsonian tactics are held up to public scorn, the tide has turned and more rapid and substantial progress may be expected.

The promoters of the Lead Cab flotilla are squeezing some of the water out of their stocks. If they will only sit a little longer on the stool of repentance perhaps they will muster up courage enough to tell their shareholders and the public what it costs to operate Lead Cabs. No doubt a further reduction of capital stock would then be found advisable.

WANTED.

Special contributors to The Horseless Age on all important subjects relating to Motor Vehicles. Fair compensation. Address The Horseless Age, 150 Nassau Street, New York.

The De Dion Company Becoming Aggressive.

As already announced in these pages, De Dion, Bouton & Co., the well-known manufacturers of gasoline motors, Paris, France, have at last started on a crusade against imitators of their motors. Unscrupulous manufacturers in Europe have undertaken to deceive the public by offering motors similar in appearance and represented to be of the true De Dion type, and this has finally spurred De Dion, Bouton & Co. to action. Hundreds of these imitation motors have been seized in European countries during the past few months, and the prosecution is now to be pushed in the United States. Through their agent in this country the patentees desire to warn the motor trade and the public in general against infringement of their rights. We direct attention to the advertisement on another page.

De Dion, Bouton & Co. were the first concern to manufacture a successful jacketless motor. In its workmanship and general design this motor is quite unique, marking an epoch in motor vehicle manufacture. It has been generally imitated throughout motordom, and much speculation has been raised in regard to the validity and scope of the patents. The claims of the patent in this country, we understand, are limited to the ignition device.

The "Walker" Steam Carriage.

The Marlboro Automobile & Carriage Co., Marlboro, Mass., have completed their first carriage. The power is steam, the fuel gasoline and the seating capacity two or four persons. It weighs 900 lbs., has 30-in. wire wheels and 2½-in. pneumatic tires.

The officers of the company are: Orrin P. Walker, of Marlboro, president; Ambrose M. Page, of Marlboro, treasurer, and Frank A. Power, mechanical superintendent.

The carriage is called the "Walker," in honor of the president of the company.

De Dion-Bouton Agency.

Kenneth A. Skinner, sole agent for the De Dion-Bouton gasoline motors in the United States, has returned from Paris and will shortly open a store in New York City for the sale of these popular motors, both air and water cooled, parts thereof and accessories, including dry batteries, spark coils, mufflers, carbureters, ignition plugs, combination reservoirs for gasoline and oil, etc. One of his leaders will be the Hydra dry battery, which is giving such excellent satisfaction in France on tricycles and light carriages. He will keep on hand a number of tricycles, motor bicycles, quadricycles and the latest success of the De Dion Co.—the voiturette seating three persons—for hire to the public by the hour or day, furnishing competent instructors and drivers to parties wishing to take lessons or go out riding. He will also have the Renault and De Dion Voiturettes manufactured here, having secured the exclusive American rights for both of them.

Mr. Skinner's present address is 268 Massachusetts Avenue, Boston, Mass., where he has a branch store.

ACETYLENE MOTOR NUMBER IN MAY.

LONDON NOTES.

London, Feb. 28th.

ADVANCING PRICES.

Many people over here are of opinion that no marked development in the adoption of horseless vehicles on a large scale can be expected until present prices are considerably reduced. Judging from appearances it will be some time before this takes place. Indeed, some firms are finding that the prices they have been obtaining have left but a small margin of profit, especially in view of the general rise in the cost of labor and materials. A case in point is a circular just issued by the Daimler Motor Co., withdrawing all quotations and list prices given for frames and complete carriages prior to Jan. 31 last.

In a circular just issued by the Daimler Motor Co., of Coventry, it is announced that in future they will fit all vehicles with a water-cooling coil. This is the result of long experience with water-cooled motors and may serve as a useful hint to constructors in America.

LAWSONISM ENDS IN LOSS.

The report of the Motor Mfg. Co., Ltd., of Coventry, for a period of 22 months ending Oct. 31 last, has been issued. It shows a debit balance of £18,161, business done to the amount of £46,190, and assets including an item of £210,980 for licenses, patents, patent rights, etc. The directors state that during the first twelve months of the period covered it was found difficult to carry on the business upon an economical basis, owing to the inefficient equipment of the works at Coventry, in respect of automatic labor-saving machinery; and although a fair amount of business was done, the year's working resulted in a considerable loss. During the remaining ten months of the period, however, a very large amount of machinery of the best and most modern description was purchased and erected, and the works are now satisfactorily organized for a fair output. The sales during 1899 show an increase of 130 per cent. over those of the previous period.

THE BILLINGS-BURNS VOITURETTE.

A new voiturette, designed by E. D. Billings, of Coventry, is being marketed by J. Burns, of Berners St., London, W. C. It is exceedingly simple, and there are one or two special points notable in the construction of the frame. This is made of tubing and consists of two layers, as it were, suitably braced together, the top frame being rectangular in plan and the lower one triangular, the apex being in front. The carriage is driven by an ordinary 2¼-h.p. air-cooled De Dion motor, and, as will be seen from the photo, it is located in front, where it is quite free to the air. Two speeds are provided, the former being transmitted by belts working on fast and loose pulleys to a small differential countershaft at the back, and from the latter to the rear axle by pinions located centrally and inclosed in an oil-containing case. The motor can be started either from the seat or by a detachable handle on the motor shaft. Special attention has been devoted to the lubrication of the motor. Steering is controlled by a long lever, the standard of which is in front of the dashboard, while there are band brakes on each of the rear hubs and one on the countershaft. The carriage weighs 400 lbs, and has a gasoline tank of a capacity sufficient for a run of 100 miles.

THE PRINCE OF WALES.

It is announced that the Prince of Wales has ordered a carriage from the Daimler Motor Co., to be delivered by the

THE BILLINGS-BURNS VOITURETTE.

end of March at Landringham, where the Prince will take lessons from a qualified instructor. Just as I dispatch this letter, however, I hear that some hitch has occurred in the negotiations, and that for the moment the order is off. More is likely to be heard of the cause of the hitch in the near future.

THE AUTOMOBILE CLUB'S ANNUAL REPORT.

I have just received a copy of the annual report for 1899 of the Automobile Club of Great Britain, to be presented to a meeting of the members on Monday next. The membership list now shows a total of 586, a gain of 206 on the year. The report shows that a loss of about £1,600 was sustained on the automobile exhibition organized by the club in June last. The programme of events to be carried out by the club during the present year is a very ambitious one, commencing with the 1,000-mile trial, concluding with a meet of motor vehicles and the annual dinner on Nov. 14.

PROGRESS IN AUSTRIA.

Excellent progress is being made in Austria. In addition to J. Lohner & Co., of Vienna, and the Nesselsdorfer Wagenfabrik Gesellschaft, of Nesselsdorf, the recently formed Leesdorfer Automobil Werke Gesellschaft is equipping works at Baden-Leesdorf to turn out annually 150 Amedée Bollée carriages, the Austrian patents of which they have acquired.

Josef Kainz, of Vienna, has lately completed a two-seated carriage fitted with a 3½-h.p. petrol motor, while Goebel, Knoller & Co., another Vienna firm, promises to have ready for the market shortly a light steam carriage of its own construction. Finally, the Austrian Daimler Motor Co. (Bierenz, Fischer & Co.), recently formed with a capital of 650,000 marks, are establishing works at Neustadt, Vienna, to turn out 100 carriages a year. The works will be under the direction of Paul Daimler, a son of the well-known inventor.

AN ENGLISH LIGHT STEAM CARRIAGE.

One of the first English concerns to turn out a light steam carriage on the lines of the Stanley, Whitney and other American models, is the Times Motor & Engineering Co., of Brighton. This concern has just completed a four-seated carriage which is fitted with a tubular boiler capable of evaporating 380 lbs. per hour, and working at a pressure of 200 lbs. per square inch. The water tubes are of copper, while the boiler is fired by kerosene in a special form of atmospheric burner. The engines consist of a pair of high-pressure cylinders, each 4 in. by 6 in., with surface condensers and giving collectively 12 h.p. Like the American carriages, the power is transmitted direct from the engine shaft to the rear axle by chain gearing. All the working parts are on ball bearings, while three brakes are provided. A carriage of this type has been entered for the forthcoming 1,000-mile trial.

HOW TO KEEP WARM.

Judging from the advertisement of one London concern the question of how to keep warm when automobiling, even on the coldest days, is simply a question of finance. The advertisement in question reads:

Wear one of our real calf leather suits, lined chamois leather, latest French style, £5 5s.; a pair of real cape gauntlet driving gloves, 5s. 6d.; then wrap a warm wool rug round your legs, 10s. 6d.; and have an apron with flaps at sides fitted to your car, protecting the legs from all wind or rain, £1 1s.; after that get a pocket warmer, 7s. 6d.; and also a large foot warmer, 12s. 6d. These precautions will enable you to keep as warm as toast on the coldest day. So they should, seeing that the total cost is only £8 2s.; or rather over $40.

A GASOLINE MOTOR OMNIBUS.

A few weeks ago I stated in this column that a motor omnibus service had been started in Kings Lynn and Norfolk by an enterprising motor and cycle agent in that town. This dealer has lately established works of his own, and while purchasing the motors and running gears, is now building his own "bodies." I am able to send you an illustration of the Kings Lynn 'bus herewith; the motor and frame is of the standard Daimler type, built by the Daimler Motor Co., of Coventry, while the body is of the agent's design and construction. One noticeable feature of it is the protection afforded the driver, the roof having been continued beyond the body to cover the box, the sides of which are also inclosed. The propelling power is a 6-h.p. Daimler motor, and the vehicle is geared up to a maximum speed of 12 miles an hour. The 'bus is licensed to carry 10 passengers—eight inside and two on the box; the interior is neatly upholstered, is lighted by an oil lamp and is provided with a lever clock. An electric bell affords communication between the conductor and the driver.

A NEW BELGIAN CARRIAGE.

M. L. Lenon, Enseval-Ces-Verviers, Belgium, has just completed a two-seated voiturette provided with a 3-h.p. motor with electric ignition, radial fins to the cylinder for cooling and a water jacketed combustion chamber. The carbureter, of a new form, is of the constant level type. The engine is located in front under a detachable "bonnet" and transmits its power by a single straight belt to either of two equal-sized pulleys on a countershaft at the rear. Each of the latter pulleys is in rigid connection with a spur wheel meshing with corresponding pinions on the differential, two speeds being in this way obtained. The carriage weighs only 550 lbs.

The Riker Electric Vehicle Co., of Port Elizabeth, N. J., are said to be building a special electric demi-coach for England, one of a number it is intended to run daily between London and Brighton, Hampton Court and other pleasure resorts around the metropolis during the coming summer.

The Automobile Club will hold a house dinner on Wednesday, March 14, at which Mr. Sturmey will read a paper on "The Automobile of To-day in Europe and America."

Electric Ignition for Gas and Gasoline Engines.

By P. P. Nungesser.

In the early days of gas and gasoline engine construction, the only method of ignition was by what was commonly known as the hot tube. The tube which entered the combustion chamber or cylinder was heated to redness by a gas or gasoline burner, which necessitated the maintaining of an open flame outside of the engine cylinder. The many dangers accompanying this form of ignition, especially on gasoline engines, made it in some localities extremely hazardous, together with the uncertainty in the period in which the ignition would actually take place due to high or low compression. Under favorable conditions, such as tight-fitting cylinder rings on the piston head and perfect fitting valves, whereby high compression was obtained and the explosive mixture forced into the hot tube to a point where the tube was at an igniting temperature, the ignition would take place at a proper period of the stroke, and high efficiency was the result.

When the opposite condition existed, such as a slight leakage at the rings on the piston head or in the valve seats, lower compression exists, causing a loss in power. This, together with the frequent breakage of the hot tubes due to the oxidation, and other uncertainties of this method, soon led inventors and manufacturers of gas and gasoline engines to seek a more reliable means of ignition, free from the many dangers accompanying the use of the hot tube. This was found in the electric igniter. Yet many builders of gas and gasoline engines have frequently met with difficulties, and sometimes failure in their efforts to obtain satisfactory results with electric ignition under the various conditions.

This is due to the many details which are overlooked and regarded by many builders as unimportant. The great strides that have been made in the perfection of the gas and gasoline engines, especially as adapted for automobile service, are due in great measure to the improvement made in electric igniters, spark coils and batteries. Perfect ignition is the most important factor in producing successful results. Engines having igniters that combine durability with simplicity have met with the greatest success in the hands of the average operator.

Another leading feature is the cost of maintenance. The writer will endeavor to explain what he regards as the most successful igniting devices in use at the present time:

They consist of two distinct classes—the primary and the secondary, commonly called the jump spark igniter. The primary igniters, which are by far the most largely used by the engine builders in this country, are constructed in three distinct forms. The first are known as the striking or make and break contact points, which are made to pass through the side of the cylinder or through the cylinder head into the combustion chamber. The movable point, which strikes against the stationary point, is actuated by a suitable mechanism on the outside of the cylinder. This mechanism is usually so arranged that ignition can be produced at the highest point of compression, or at the point where the highest efficiency is obtained with the combustible mixture contained in the chamber.

The second form of primary ignition, commonly known as the rotary or wipe spark igniter, is not so largely used as the striking or make and break type just described. One objectionable feature that the writer has not yet seen successfully overcome in the rotary type is the great wear in the sliding contact points. It is true this form of ignition produces a much larger spark with the same consumption of battery power than the striking or make and break igniter, but the frequent attention that this form of sliding contact ignition requires to keep it in perfect condition will prevent it from ever becoming as popular as the striking or make and break ignition.

The third form of primary ignition used is the make and break igniter known as the inside igniter. This igniter is constructed by passing the insulated stationary rod through the side wall of the cylinder, or through the cylinder head. The movable part of this igniter is attached to the piston head inside of the cylinder, and when the piston head compresses the explosive mixture to the highest point of compression the igniter, which has been brought in contact by the forward motion of the piston, is separated by the movement of the piston head, thereby igniting the mixture.

There are many other forms of primary ignition in use, but those described above are the most largely used in this country.

The second class of igniters, commonly known as the jump spark igniters, have only one form of construction. This is an insulated plug through which the wires from the induction or secondary coil pass to the inside of the combustion chamber. The two wires which pass through the insulated plug are usually spaced from ½ in. to ⅝ in. in passing through the plug, and curved inward or toward each other to allow from ⅛ in. to 5-16 in. air space through which the spark passes from the positive to the negative wire. It will be noticed that no movable parts exist in this form of ignition. When the battery is closed by suitable insulating plates on the revolving shaft of the engine, a spark is produced in the combustion chamber or cylinder.

The insulating plugs used for this secondary current, or jump spark ignition, must necessarily have very high insulating properties. They are usually made of lava, which is a composition of soapstone, or made from mica, which has high insulating properties.

The Rhumkorff or induction coil, as it is sometimes called, which is used to produce the jump spark, is constructed with a primary coil of coarse or heavy wire having a soft iron core. Over the primary coil are wound a great many layers of very fine, insulated copper wire having no metallic connection with the wires of the primary battery coil.

When a battery current passes through a primary coil it magnetizes the iron wire core, and also charges the tin foil condenser which is usually placed in the base of the coil. When the battery circuit is closed a current of very high voltage is produced by the induction in the secondary coil, the ends of which terminate in the ignition plug inside the combustion chamber. This high voltage causes a spark to pass from the positive to the negative wire inside of the combustion chamber.

To ignite an engine successfully with any of the above forms of ignition, a battery of great strength and durability is absolutely essential, and is by far the most economical to use. These requirements are only found in a closed circuit battery that is manufactured expressly for high speed engines, such as used on automobiles and pleasure yachts. Practical tests and demonstrations on automobile and yacht engines have proven that a battery having from 4½ to 6 volts, or ¾ to 1 volt per cell, to be the correct voltage to use. The battery should have a very low internal resistance and have an amperage or current discharge of from 8 to 16 amperes on closed circuit measurement. A closed circuit battery, such as the Nungesser No. 1 and No. 5 Portable Batteries, which are made expressly for this service, will meet the above requirements.

Too much cannot be said about the use of a suitable primary spark coil in connection with any of the primary igniters. It has required many tests to determine the correct resistance to have in the coil. If the resistance is too low, the coil will allow too large a flow of current from the battery, thus wasting very much of the battery power; also frequently destroying the platinum points on the igniter.

To obtain the best results, from 1½ to 2 amperes should be the limit of discharge through the coil. Coils are now wound for four, six and eight cells, as the case may be.

Since the early days of electric ignition many forms of spark coils have been used—in fact, any coil that would produce a large spark was considered the correct coil to use, irrespective of the great waste in battery power. Many spark coils in use to-day are wasting as much current as is required to successfully ignite the engine. This is due to the very low resistance of the spark coil, which allows twice the amperage or current to flow through the coil when the circuit is closed as is necessary for successful ignition. This waste of current is prevented by having the correct resistance in the coil, so as to produce a reliable spark and prevent any waste in the battery power. It has been found from actual tests on modern engines that by having a coil of the correct resistance the life of the battery has been doubled.

Another great improvement in ignition and saving in battery power was effected by discarding the old style long coils, which were 8, 10 and 12 in. in length (an erroneous idea existed that a long coil would produce a larger spark). Practical experience and tests have shown that a primary spark coil best suited for high speed engines, such as used on automobiles and pleasure yachts, should not exceed 6 in. in length over all. The 8, 10 and 12 in. coils will not, with the same consumption of battery power, magnetize and demagnetize as rapidly and completely as the 6-in. coil; consequently, the latest improved primary coil has an extra large diameter core, which is composed of No. 20 annealed Swedish iron wire, re-annealed after cutting to 6 in. in length. A coil having a core made of this grade of iron and with this degree of care will magnetize and demagnetize instantaneously. This enables the engine builders to provide for only a short duration of close—that is, allowing the circuit to remain closed only half as long as would be required to produce the same results with an 8, 10 or 12 in. coil. It is therefore a great economy in battery power to use a 6-in. coil, and the results are much more satisfactory.

Another important feature in the construction of primary spark coils for automobile use is the thorough waterproofing of the spark coil to produce thorough insulation under all conditions met with in use. No spark coil, if not proof against dampness and moisture, will give satisfactory service for any period of time; it is therefore necessary to have the coil thoroughly water proof.

No form of dry battery should be used for continuous use. All dry batteries and sal ammoniac batteries are open circuit batteries, and only suitable for periodical work. The first cost of a dry battery and sal ammoniac battery is very low, but its life in heavy service is very short. Dry batteries are sometimes used for starting an engine where a dynamo is used for continuous ignition. A number of builders are using dry batteries for starting their engines, and as soon as the required maximum speed is obtained an automatic switch cuts the battery out of the circuit and closes the dynamo circuit. This is also sometimes accomplished with a two-point switch, and the dynamo will then ignite the engine until the speed is reduced. While the dynamo or generator is used, the batteries are at rest.

The writer considers a good portable closed circuit battery not only more economical than the dry battery and dynamo combination, but it requires less care, as there are fewer parts to become disarranged in the rough service to which ignition devices are subjected in gasoline automobiles and launches. It is a mistaken idea that dynamos or magneto-generators do not require any attention or repairs. The high speed at which these generators are usually driven produces considerable wear on the movable parts, and they have been abandoned by many of the progressive builders.

Many builders of vehicle and yacht engines have had difficulties, no doubt, with the many forms of closed circuit batteries. These difficulties are sometimes easily located. A closed circuit battery in which a paraffine oil must be used on the solution should be avoided, as it will be found to give short life and comparatively poor service. This is due to the rough usage in carriages and boats causing the paraffine oil to coat the elements and interfere with the action of the battery. A perfectly sealed or liquid-tight battery does not require any oil to protect the solution from the atmosphere. A battery which may show excellent service in stationary use may be a complete failure in portable use.

There are no trade secrets about electric ignition. The degree of success that the various manufacturers are meeting with depends entirely upon the amount of attention that has been given to the most important details, which the writer has endeavored to explain in this article. There are perhaps other causes for success or failure in electric ignition, but those referred to are from the writer's personal experience and observations made in the past 10 years, or since the development and perfection of the gas engine in the United States.

MINOR MENTION.

Minneapolis, Minn., is to have an automobile club.

The Oakman Motor Vehicle Co., capital stock $600,000, has been incorporated under New Jersey laws.

The Ashton Valve Co. illustrate their new pop safety valve for steam carriages in their advertisement this week.

The Chicago Motor Vehicle Co. has purchased a factory at Harvey, Ill., and will manufacture all kinds of gasoline vehicles. J. E. Keith is the general manager and the inventor is W. O. Worth.

Alarmed by the purchase of motor vehicles by the War Department, French breeders of horses inquired of the War Minister as to the truth of the rumor that the department would purchase no more horses. The minister denied the report. The mobility of the horse renders him indispensable in military service.

The Buffalo Electric Vehicle Co. has started a shop on the Military Road. The following officers have been elected: President, F. A. Babcock; treasurer, Isadore Michael; directors for the first year, F. A. Babcock, Isadore Michael, E. C. Randall, Theodore S. Fassett, Leonard B. Crocker, Henry C. Diehl, of Buffalo, and Hon. Jacob Amos, of Syracuse.

The New England Electric Vehicle Transportation Co., Boston, Mass., is about to reduce its capital stock from $25,-000,000 to $5,000,000. The board of directors have prepared a resolution to this effect, which is to be submitted at the coming annual meeting on April 3. The stock now stands $10, paid in or called, which will be made full paid if the recommendation of the directors is adopted.

METROPOLITAN ITEMS.

The Hancock Inspirator Co., makers of injectors, have moved their office from Boston, Mass., to 85 Liberty St.

The Prentiss Tool & Supply Co., 115 Liberty St., are introducing a new turret lathe to the trade.

Townsend & Decker, patent attorneys, 141 Broadway, are making a specialty of motor vehicle patents.

The No. 2 U. S. Storage Battery is being successfully used for ignition purposes.

A Lemp Hydraulic Checking Device, devised and patented by Hermann Lemp, motor vehicle engineer of the General Electric Co., is on exhibition at the rooms of the Automobile Club.

Motor vehicle inventors will be interested in the "Handbook of Testing Materials," published by John Wiley & Sons, 43 East Nineteenth St. It is in two volumes and contains over 1,000 illustrations.

The Manhattan Brass Co., 332 East Twenty-eighth St., are making a special bracket for the attachment to the dash of their "Improved Front Light" kerosene lamp. The lamp is brass riveted and clinched throughout, and has a powerful reflector and automatic wick lock.

J. W. Cregar, New York agent of the Pratt & Whitney Co., is interested in a new anti-friction bearing resembling the graphite bearing in principle. It is made by taking a bushing, boring it full of holes, plugging the holes with a hard wood imported from South America and treated with a secret chemical process and then bringing the end of the grain of wood to bear on the revolving shaft. Successful tests are said to have been made on high speed machinery, and the patentees are introducing it to the motor vehicle trade.

LESSONS of the ROAD

Facts and Kinks.

Buffalo, N. Y., March 7.

Editor Horseless Age:

My summer's experience in driving a gasoline carriage has taught me many little facts and kinks that may interest your readers.

The carriage seats two persons. It weighs 900 lbs. when ready for a 100-mile trip. It carries 10 gals. of water, 3½ gals. of gasoline and a pint of oil. I usually pay 15c. per gallon for gasoline. Am told I could buy by the barrel for 10c., but I have no place to keep so large a supply.

The oil costs me 50c. per gallon, the best I know for the purpose being the Standard Gas Engine Oil. If any of your readers know of a better, I would be thankful to learn.

I find after many trials that I use 1 gal. of gasoline for 30 miles of average roads. The speed varies from 4 or 5 to 25 miles an hour, and seems not to make much if any difference in consumption of fuel, for the faster I go the shorter the time to be sure, but the motor, of course, is speeded up with the carriage and uses more in the shorter time. I may explain here that I have two means of control over the motor speed, one by shutting off the gas, and the other by changing the time of the spark that explodes the charge, so I may vary the motor speed from 150 revolutions per minute to 1,200 or more. It is a great convenience, saving fuel, reducing noise and vibration and permitting me to leave the carriage with the motor slowly turning over, ready for work at once on my return.

I have succeeded in using gasoline of as low a test as 59 degs. and as high as 88 degs., and of temperatures as low as 22 degs. and even 20 degs. Once I failed to start with cold gasoline and found its temperature to be 14 degs., but upon warming it a little had no difficulty, the motor starting promptly. I try to buy a grade that tests 74 degs., which is the ordinary stove gasoline. The above figures show that a considerable variation in the fuel may be permitted with a good motor.

The motor is called a 5-h.p. Brake tests have shown 4¼ on several trials, sometimes a little more.

Having tried three methods of ignition with more or less success, I am now using an electric spark called the wipe spark, produced by a rotating cam wiping off the end of a spring with a sharp snap. The spark is large and sure. The rubbing action cleans the contact points. Oil improves its action, even increasing the spark, and the smoke in the cylinder has no effect on it.

With the jump spark I had trouble continually, it being necessary to clean the points often, and the outside insulation was a constant care.

The contact or hammer spark was good, and gave less trouble, but so far I have had the least trouble with the one in use. In fact, it has never failed me. How much it would have added to my comfort to have known this early in the season! Many anxious hours have been spent hunting the spark. I can laugh now at the remembrance of times when removing and cleaning the points in the dark, or by the light of a match, everything hot to the touch, the curious crowd at hand to offer the usual advice, and make fun of the useless machine that will not go. One has to become case hardened, as it were, to stand the annoyance without showing it.

E. N. B.

COMMUNICATIONS.

Explosive Motor Details.

Clinton, Mo., March 2.

Editor Horseless Age:

I wish very much to know, referring to Fig. 6 of "An Explosive Motor in Detail" in your Explosive Motor Number, what is the dimension for dimension line almost parallel with C D; what is the outside diameter of cooling flanges, and the pitch of these flanges? The thickness at base and outer edge is given, but nothing regarding their depth.

Is there no formula for calculating the proper surface of these flanges or determining their depth in proportions of cylinder diameter?

Also, about what seems to be the most practical limit in size of cylinder dimensions for this method of cooling?

C. M. M.

1. The diameter over cooling flanges is given in Fig. 6 as 5 in., which is about what it scales, the drawings being one-half size.

2. No formula for radiating surface would be of any value which did not take account of the temperature and the volume of the air blowing over the flanges. These motors can very readily be overheated when the carriage is standing still, by running them with the full supply of mixture and then slowing them down by a brake on the fly wheel. It is always best to make the flanges as large and light as the conditions of manufacture will permit.

3. About 3.25 in. diameter of piston, under ordinary conditions. The length of stroke is immaterial.

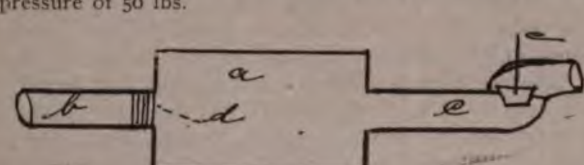
HERBERT L. TOWLE.

An Unforeseen Difficulty.

Paris, Texas, March 2.

Editor Horseless Age:

Let a be a cylinder fitted with the pipes b and c, b having a wire gauze at d, and c with a pop valve, e, set to open with a pressure of 50 lbs.



Now let a proper mixture of air and gasoline into the cylinder through b. Under 75 lbs. or more could it be burned in a, and, once it were lighted, would heat enough be generated to ignite the incoming mixture? C. E. B.

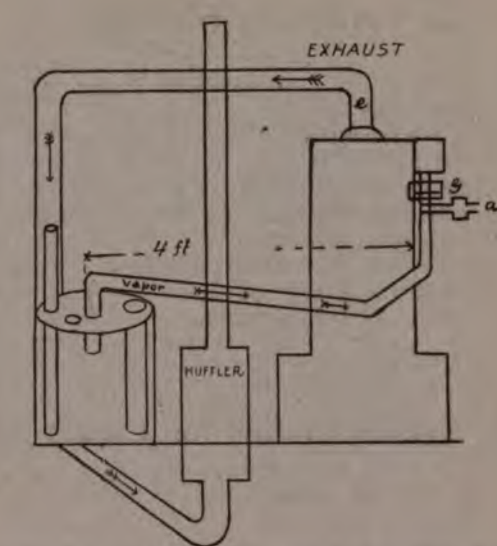
[Yes; but it would soon destroy the pop valves.—Ed.]

What Was the Cause of This Explosion?

Brooklyn, N. Y., March 6.

Editor Horseless Age:

I have built a 4-h.p. Otto cycle gasoline engine for vehicle use, and am experimenting with it almost daily. Yesterday, when everything apparently was in the usual working order,



the carbureter exploded, fortunately doing little damage. I am at a loss to account for the accident, and submit a rough sketch of the engine and connections. It has two valves, the gas valve being located above the air valve. The carbureter I made out of a 5-gal. gasoline can. The feed pipe was 1 in. in diameter and the nipple extended into the can about 2 in. Inside the carbureter were two sections of pipe, one 2 in. in diameter, the other 1 in., reaching within 1 in. of the bottom. There was a vent hole half an inch in diameter in the top of the carbureter. The carbureter, as shown in the sketch, was placed on the exhaust pipe about 8 ft. from the exhaust valve. I used electric ignition and there was no fire near. The engine was running at about 400 revolutions, but just previous to the explosion it slowed down perceptibly. The top of the carbureter blew off, but the gasoline tank did not explode, although it was badly battered. Strange to say, I noticed that immediately after the explosion the gasoline tank was cold as ice. The compression in the engine is high. S.

The mixture in a carbureter cannot explode spontaneously under any conditions that would occur in practice; and for the explosion to have taken place as described, the gasoline vapor must have escaped from the tank and come in contact with some igniting agent. Such agent would most probably be a spark due either to a defective connection somewhere in the circuit, or to an irregular leak or "ground" between the wire and the engine. As the engine slowed down before the explosion occurred, the remaining heat of the exhaust pipe under the carbureter might readily cause sufficient accumulation and escape of vapor to produce this result. If the exhaust pipe were very hot, it might alone ignite the vapor, but this could only happen from excessive flame escaping in the exhaust, and it should not and seldom would occur.

It is safer to warm the air entering the carburetter than it is to apply heat to the carburetter itself, and with the former arrangement the accident described could hardly have occurred.

HERBERT L. TOWLE.

An Erroneous Formula.

Brooklyn, N. Y., March 9.

Editor Horseless Age:

I find there is a typographical error in the article on "Facts Versus Claims for Liquid Air." I refer to the formula on page 2 of the manuscript—in fact, it is the only formula in the article. The figure 4 beginning the equation should be W. It should read as follows:

$$W = 183.45\ T\left(1 - \frac{(T'}{T'} \times \frac{T')}{T}\right).$$

HUDSON MAXIM.

Facts Versus Claims for Liquid Air.

By Hudson Maxim.

Liquid air is such a strange substance and so readily lends itself as a plaything for the imagination, as well as for the, hands, that many have been ready to believe the most absurd things concerning it. When it was first discovered that air could be liquefied, it was so very expensive as to preclude any serious considerations of its usefulness, except as a scientific curiosity. But when Tripler showed that it could be produced by the gallon, and at low expense when compared with its cost by earlier methods, the question naturally arose concerning its commercial value.

So extraordinary are some of the claims which have been made for liquid air as a motive fluid, that the public eye is beginning to look askance at its mere mention in connection with any commercial application. This is unfortunate, both for the public and for the promoters.

Ignoring propositions for the production of perpetual motion by liquid air, which have been made and exploded, let us consider claims which are now being made by advertisers in the public press, from which I quote the following:

"The use of liquid air in the generation of power on land and sea will reduce the cost to one-half of that now paid for steam power. This statement carries its own argument, and needs no elaboration."

"In the production of motive power, liquid air has a wonderful future as a fuel saver. Liquid air, after a short exposure, loses most of its nitrogen (the chief obstacle to combustion), and the resultant oxygen used in connection with carbon (coal, coke, etc.) produces perfect, smokeless combustion, avoiding the large percentage of loss now incurred in the use of fuel."

Liquid air is not a magic wand by which miracles may be wrought, and yet it is hard to see how, without the enlistment of the miraculous, such results can be accomplished.

Examining the first of these claims, let us compare liquid air with steam as a motive fluid, under like conditions, in a triple expansion marine engine. It is common for such an engine, with 250 lbs. steam (260 lbs. absolute pressure), to produce a horse-power hour for every 1½ lbs. of coal consumed. Now suppose we were to substitute liquid air for the water. We should still require boilers for its evaporation, and to make it as economical as possible, let us assume that we heat it to the temperature of steam at 250 lbs. pressure—in other words, to 406 degs. F. It must be assumed that the air is to be expanded four and one-half times, which is the average ratio of expansion in compound triple-expansion engines at the present time. To determine the weight of any motive fluid required for 1-h.p. hour, we have the following formula:

$$4 = 183.45\ T\left(1 - \frac{T''}{T'} \times \frac{T'}{T}\right)$$

in which W is the work in foot-pounds, T is the initial temperature, T' is the temperature after expanding to do work, and T" is the temperature after expanding from the last temperature to atmospheric pressure. (Clarke's Manual of Rules, Tables and Data, page 909.)

Solving the above formula, the result obtained is 78,607.6 ft.-lbs., as the energy in 1 lb. of air at 250.3 lbs. pressure and 406.2 degs. F. temperature.

Therefore, 1-h.p. hour would consume 1,980,000 + 78,607.6 (foot-pounds in 1 lb. of air) = 25.19 lbs. of liquid air. It would take .7 lb. of coal to evaporate this amount of air and superheat it to the temperature of saturated steam at 250.3 lbs. pressure (406 degs. F.). Hence, we should need nearly half as much coal per horse-power hour for the air as for water. By any means now known which could be employed on shipboard, the amount of heat which could be absorbed from the air and water and utilized would in practice be a negligible quantity. As air could not be recondensed, like water, we should be obliged to load up with enough liquid air to last the whole voyage without recondensation.

The engines of the Teutonic develop about 20,000-h.p. This would require 242 tons of liquid air per hour, 5,829 tons per day and 40,807 tons for a seven-days' voyage, considerably more than enough to float the vessel.

Some have made the claim that liquid air can be made as cheap as 2 cents per gallon. Let us assume, for argument's sake, that such be the cost. This would be $4.28 per ton, and liquid air enough to take the Teutonic across the ocean would cost $174,560. In other words, it would cost this sum to save about half the coal bill.

This is, of course, without taking into account the additional horse-power which would be required to carry the enormous cargo of liquid air necessary.

Referring to the second of the claims above quoted, it requires about 2 2-3 lbs. of oxygen to burn 1 lb. of carbon. Air contains 22.92 per cent., or, roughly, 23 per cent. of oxygen. A gallon of liquid air weighs about 9.351 lbs., 2.143 lbs. of which is oxygen. If the nitrogen were separated so that all of the oxygen were saved, and if this could be done without expense, and if liquid air could be produced for 2 cents a gallon, then the oxygen would cost .9333 cent per pound, or $18.67 per ton. Now, let us assume that the coal costs $3 per ton. It would therefore cost $49.80 to save $3 worth of coal.

With regard to the use of liquid air for internal combustion engines or explosion motors, it is estimated that in the Diesel motor, which is one of the most economical, both for the fuel and air consumed, it requires about 10 lbs. of air to produce 1-h.p. hour. This would require about 1 gal. of liquid air per horse-power hour; and if liquid air can be produced at 2 cents a gallon, then it would cost, in addition to the fuel, 2 cents per horse-power hour.

The contingent loss of liquid air by evaporation in transportation and handling, and while motors in which it is employed are standing idle, would certainly counterbalance any advantages which might exist from having the air in concentrated or liquid form.

Liquid air will be chiefly valuable as a source of oxygen for other purposes than the production of motive power.

OUR FOREIGN EXCHANGES.

De Dion and Bouton's Changeable Gear.

Fig. 33 is a section through the driving shaft of the motor.
Fig. 34 is a side view with partial section.
Fig. 35 is a section on the line A B of Fig. 34.

DESCRIPTION.

a is the motor shaft, at the end of which is mounted a system of bevel gears forming a differential. The gear b is fastened to the squared portion and the gear c makes one body, with a toothed socket, g, loose on the same shaft a, and designed to transmit the motion to the axle of the driving wheel. The other two wheels, d and e, turn freely on the axis h, which forms part of an arm, i, loose on the shaft a. These pinions are supported on the extensions of the square parts, work in the grooves k turned in the rim m, which envelops the entire system of gears. This rim, sectionally represented in Fig. 35, is strengthened by two strong interior ribs n n, on which are fastened two pieces, o o, each provided with a tooth, p, of such a shape enabling it to adapt itself exactly between the space between the teeth of the gears d or e. These two wheels are placed in the space found between the ribs n.

It is evident, on examining Fig. 2, that the rim m is not supported by the square extension t of the axis h, and consequently it can displace itself by yielding to the arm i at a certain angle, which depends on the size of the groove k. This angular displacement should be sufficient to allow the tooth p, engaged in the teeth of the wheels d and e (Fig. 34), to disengage itself completely. The spring r, one end of which is fastened to the rib j and the other to the arm i, draws down the latter into the initial position, as shown in Fig. 2. S is a brake band acting on the rim m.

In consequence of the engagement of the pinions d and e with the gear b, the arm will always tend to turn in the same direction as the gear b, with the same speed or speed reduced to one-half, depending on whether the gears d and e are rigid or turning on the axis k. The operation of the mechanism is as follows: In the position of repose the teeth p connected to the ribs n are fast in the space between the teeth of the gears d and e on account of the presence of the spring r. It follows, therefore, that the gears cannot turn on their axes b. If we assume that the shaft a turns with a certain speed in the direction of the arrows 3, it is evident that it will carry around the gear b, which is connected with it, which in turn will carry around the cross bar i and the gears d and e, rendered immovable by the tooth p. The gears will draw along in their revolutions the piece o and pinion g in the same manner, which turns the entire system with the shaft a, and at the same speed as the latter. To reverse the direction of the carriage it suffices to apply the brake band s to the rim m, which does not participate in the rotation of the whole in consequence of the traction of the spring r.

The rim m being immovable and the cross arm n continuing to revolve, displaces itself from the groove k and comes against the projection t.

In this position the teeth p are disengaged from the gears d and which, becoming free, turn on their axes. On the other side the cross arm i, being loose on the shaft, will remain immovable with the rim m; but, as it is inclined to take a speed equal to half that of the shaft a, the pinions d and e will remain out of contact with the teeth p, in spite of the tension of the springs r, or until the action of the brake s

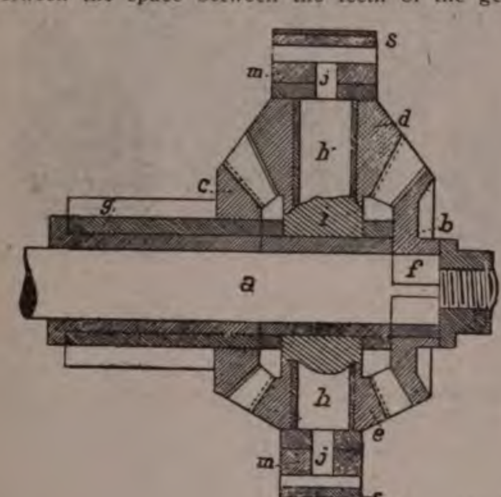
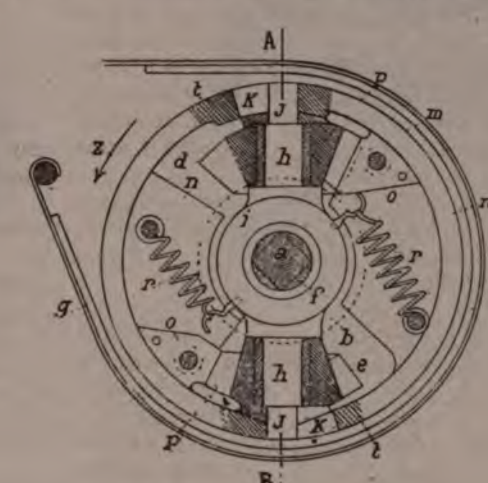


Fig. 33



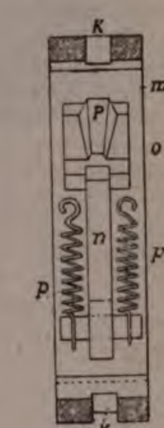


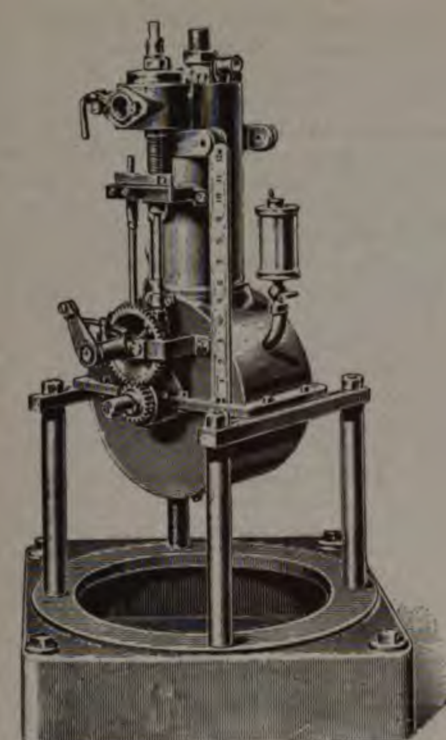
Fig. 35

ceases and the rim m becomes again free, when the springs r draw the parts into the position represented in Fig. 2 and the rim m will be again drawn back by the rotation of the cross arm i, which now turns with the same speed as the shaft a.

It is easy to see that during the entire time of the braking the rotation of the gear e, and, in consequence, that of the pinion g, will be the reverse of that of the shaft a.

The Wellington Motor.

This motor, which we illustrate herewith, is entirely of British design and manufacture, having been designed by J. Morecraft Wellington, engineer of the company, and built by The Wellington Motor Car Co. (Ltd.), of 37 Victoria Road, Battersea, S. W. It is intended for use in the smaller class of automobiles, such as voiturettes, dogcarts, etc. It comprises a single vertical cylinder bolted to an inclosed crank chamber. So far it follows conventional lines. There are, however, several mechanical details about it which serve to differentiate it from others of its type. The cylinder is 3 in.



WELLINGTON MOTOR.

diameter by 4 in. stroke. It is water-jacketed, as is the cylinder cover. These jackets are quite independent of each other, and the cover can be easily removed for inspction, the joint between the cover and cylinder head being metal to metal, forming a V joint—no packing of any kind being used.

The crank or fly wheel chamber is in two portions, which are united by horizontal flanges bolted together. It is thus very easy to get at the main bearings and cranks. Ball bearings of a special type are used in these important parts, and from repeated tests made with them and plain ones, The Wellington Motor Car Co. (Ltd.) find that by the use of ball bearings they save, so they assure us, quite half a horse-power. The inhaust and exhaust valves are neatly arranged so that either can be quickly overhauled without disturbing the other, the inhaust valve being placed immediately over the piston, which thus gets the full advantage of the explosive impulse.

The make and break mechanism of the electrical ignition is so arranged that no oil which is used to lubricate the distributing gear can possibly get on to it to so spoil the contact, as it is placed high up on the side of the cylinder. We should state that this is, of course, a second motion shaft as seen, the motor working on the Otto cycle and using petrol as fuel. This motor has been very carefully and repeatedly tested, with the mean result that at 1,400 revolutions per minute it gives 3.8-b.h.p. It is, however, classed by its makers as a 3½-h.p. motor, so as to allow a margin within which it can be guaranteed. Its weight is, exclusive of induction coil and batteries, 110 lbs., and the consumption of petrol, at full load, being ⅞ pint per horse-power-hour, and at half load ⅝ pint per horse-power-hour; the cost of running being thus (taking petrol at 11¾d. per gallon) 1⅛d. per horse-power per hour.—The Automotor.

According to La France Automobile, Charron, the well-known chauffeur, has had electric ignition put on his 12-h.p. Panhard carriage, with the result that the power is increased.

The Esty Motor Vehicle Wheel.

William Esty, manufacturer, Laconia, N. H., is the inventor of a special motor vehicle wheel, which we illustrate herewith. It is a combination of the wire and the wood wheel. The torsion resisting wire spokes are made with hexagon heads instead of round heads, as shown in photo, the nipples being pressed tight into the rim with white lead to prevent any moisture from entering around the nipple, as would be the case if the nipple were turned to tighten the spoke, as is done in the ordinary wheel.

THE ESTY MOTOR VEHICLE WHEEL.

The hubs are metal and webbed, so as to get the greatest strength with the least weight. The rear hub has a flange to bolt a gear, band brake or sprocket wheel to, as might be desired, or the hub can be keyed fast to the rear axle, if the sprocket wheel is in the center. Any style of roller bearing may be used.

This particular wheel, shown in the photograph, has a 2-in. axle, 6-in. rim and 5-in. solid tire, and is for heavy truck service, suitable to carry a load of 3 tons or more.

Test of the Motsinger Device.

Jno. L. French, president of the St. Louis Motor Carriage Co., writes of a very satisfactory test he recently made of the Auto-Sparker manufactured by the Motsinger Device Mfg. Co., Pendleton, Ind. He says:

"This device consists of a small dynamo, specially wound with armature, commutator, etc., inclosed; weighs 23 lbs.—about one-half the weight of batteries we have been using—and takes less than half the space. This dynamo is so constructed that armature field magnets and shaft bearings swing between two pivoted points of base. One end of armature shaft carries a small friction pulley, the other a very small governor. The dynamo is preferably set under fly wheel, so that friction pulley is in contact with it, an adjustable coil spring holding pulley against fly wheel rim. As the speed increases, the governor presses a small tapered sleeve against a correspondingly tapered steel point, mounted on dynamo base. This raises governor side of shaft and swings pulley clear of

fly wheel; as speed falls, pulley again comes in contact with fly wheel, maintaining dynamo at nearly constant speed.

"One of these machines, temporarily, was mounted upside down under the seat of one of our runabout buggies. On testing it in shop with speed indicator, dynamo revolutions did not vary over 20 per minute, notwithstanding engine was run from 100 to 1,000 revolutions. Afterward we took the carriage out, and spent the afternoon running it over all kinds of roads, in order to see if shaking affected it. Notwithstanding the extremely hard test and fast speed at which at times we rode, in nearly a 40-mile drive, it ignited the charge every time, the engine not missing a single explosion. The dynamo seemed to generate sufficient spark at slowest speed and engine was started as easily as with battery—in fact, several times at starting the charge would be ignited on a quarter turn, before engine had passed the center. We believe Mr. Motsinger has devised a dynamo that answers every requirement and does away entirely with the necessity of batteries."

New York State Motor Vehicle License Bill.

We give the full text of the new license bill which was recently introduced in the Assembly by Mr. Apgar, of Westchester county. It is as follows:

An act to regulate and govern the running and operating of all motor carriages and vehicles other than railway or traction engines, upon the public highways in the State of New York.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. It shall not be lawful for any person or persons to run, operate or use any motor carriage or vehicle upon the public highways in the State of New York without first obtaining a license as hereinafter provided.

Sec. 2. The Board, department, commission or other local authority in the cities, counties, towns and villages of this State where such authority exists, who are now or may hereafter be charged by law with the duty of boiler inspection, or passing upon the qualifications of engineers, are hereby charged with the duties prescribed in this act, and are hereinafter referred to as the examining board.

Sec. 3. In the counties of the State where no local authority exists charged with the duty of boiler inspection, or passing upon the qualifications of engineers, it shall be the duty of the board of supervisors of each county to appoint or designate one person in each town in said county who shall be charged with the duties prescribed in this act, and referred to herein as the examining board; such person so appointed or designated shall be paid by the owner of each motor carriage or vehicle, the sum of $1 as a fee or charge for such examination, in addition to the license fee as hereinafter provided.

Sec. 4. It shall be the duty of the examining board to examine all persons applying for license, and to inspect, examine and test the carriage or vehicle proposed to be used. If the person is found competent to run and operate the same without injury to the public, and if the said carriage or vehicle is found to be in a safe condition, the examining board shall issue a license signed by the board, or by its order, upon the payment of a license fee of $2 for each carriage or vehicle. Nothing herein shall require or shall be construed as requiring any persons applying for a license to be an engineer, electrician, mechanic or other mechanical expert.

Sec. 5. The said license shall fully authorize such licensee to keep, own, store, install and care for the said motor carriage or vehicle, and to run and operate it in, through, across and upon all the public highways, streets, parks and parkways in the State of New York, for a period of one year from the date thereof, anything in the statutes or laws of the State of New York to the contrary notwithstanding.

Sec. 6. Each examining board is hereby authorized to revoke or suspend for a period not exceeding six months, any license issued by it, upon satisfactory proof of the drunkenness, incompetency or reckless driving of the licensee. Such provocation shall not be made without five days' notice of intention, in writing, to the holder of the license, nor without a public hearing, at which the licensee may appear in person or by counsel. Where such license has been revoked, as provided herein, a like certificate shall not be issued to the same persons within three months of the date of the revocation.

Sec. 7. Any person or persons violating the provisions of this act shall be guilty of a misdemeanor, and upon the conviction thereof shall be subject to a fine of not less than $10 or more than $100.

Sec. 8. Any person or persons obtaining a license under the provisions of the act shall keep the same with them, or upon their carriage or vehicle when actually running, operating or driving same.

Sec. 9. All acts or parts of acts in so far as they in any way conflict herewith, with respect to motor carriages and vehicles, are hereby repealed.

Sec. 10. This act shall take effect immediately.

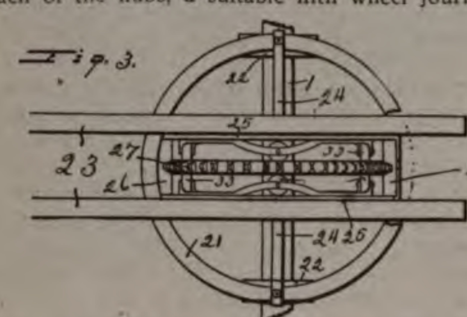
MOTOR VEHICLE PATENTS

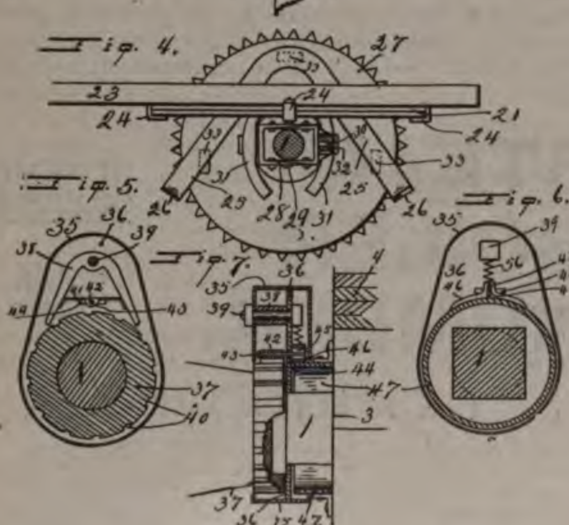
of the world

UNITED STATES PATENTS.

No. 644,843—Motor Vehicle.—Anthony Bink, Stockton, Cal. Application filed April 27, 1899.

Claim.—In a motor vehicle the combination of two rotatable axles, wheels loosely mounted on the axles and having suitable notches in the hubs thereof, suitable clutches rigidly attached to the axles, and adapted to engage with said notches in each of the hubs, a suitable fifth wheel journaled to the

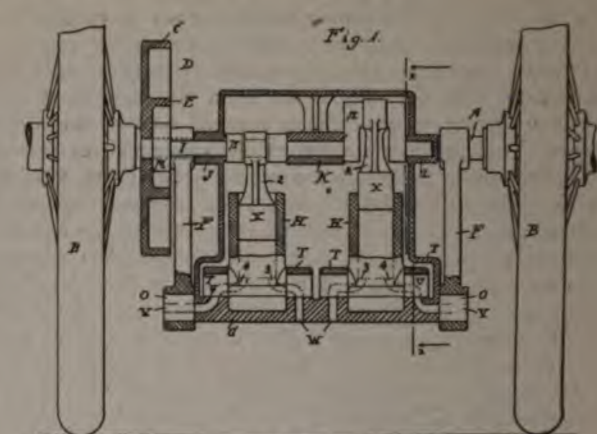




center of each axle, a reach attached to and connecting the said fifth wheels, a suitable sprocket or grooved wheel attached to the center of each axle, a suitable chain belt adapted to engage with said sprocket or grooved wheel and a power wheel located in the body, guide pulleys located beneath the body, and the body aforesaid mounted on bolsters, said bolsters mounted on springs which are journaled on the axles.

No. 644,598—Motor Vehicle.—Charles O. Heggem, Massillon, O. Application filed April 17, 1899.

Fig. 1 is a longitudinal sectional view of the invention, showing one form of frictional clutch secured upon a vehicle axle or driving shaft; Fig. 2, an end elevation, partly broken away, of what is shown in Fig. 1, parts being also in section;



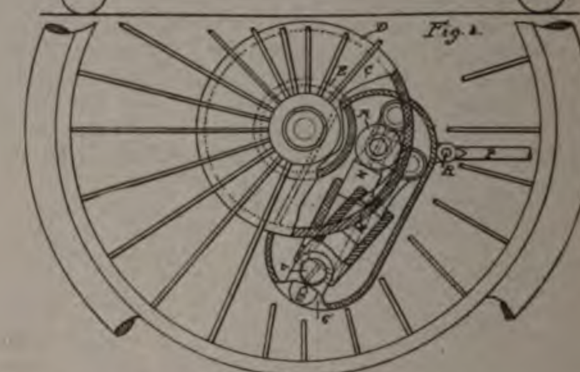
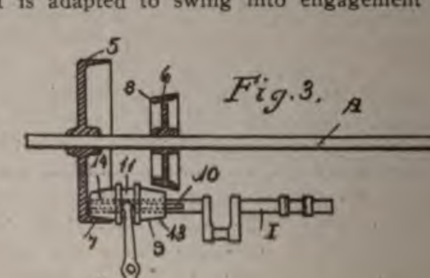


Fig. 3, a detail view showing a different form of clutch; Fig. 5, a sectional view on the line x x of Fig. 1, looking in the direction of the arrows and showing one of the engine cylinders in such a position that the inlet and exhaust ports are cut off; and Fig. 6, a similar view to Fig. 5, showing the inlet port in communication with one of the cylinders.

The letter A represents one axle of a vehicle to which the invention may be applied. Upon this axle is mounted a pair of wheels in any suitable manner. One member of a friction clutch, C, is also mounted upon this shaft or axle. This friction clutch carries an outer and an inner flange, such as shown at D and E, respectively, such flanges being adapted to be engaged by the other clutch member in a manner presently to appear, whereby when the interior of the outer flange D is engaged the axle will be driven in one direction, and when the exterior of the inner flange E is engaged the axle will be driven in the opposite direction. A pair of pivoted arms, F, are supported at one end by the axle A and carry at their other end a swinging housing G, such housing carrying one or more single engines, H, and also the shaft I, the latter being mounted in bearings J, K and L, respectively.

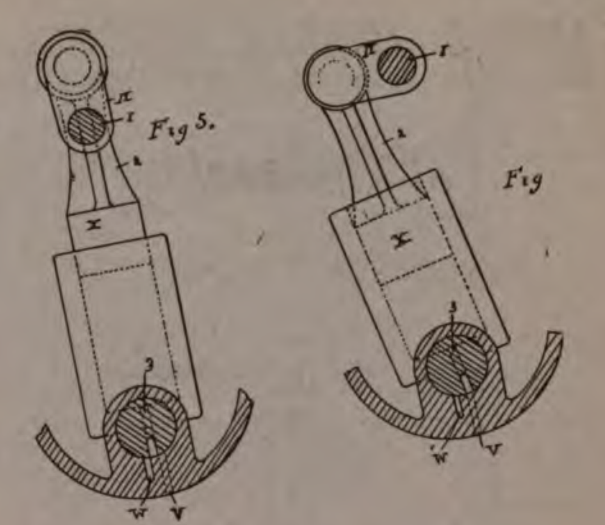
The shaft I carries a roller, M, and also cranks, N. The roller M is adapted to swing into engagement with either



of the outer or inner flanges of the clutch member in a manner presently to appear. As above stated, the housing G is mounted upon the arms F, so that it, together with the crank shaft I, may be freely swung from bearings, O, in the lower ends of said arms. This is accomplished by means of a pitman, P, pivotally connected to the housing G, as shown at R. The other end of this pitman engages with a hand lever, S, as shown in Fig. 4. As this hand lever is operated the pitman is reciprocated back and forth, and consequently the housing G is moved backward and forward thus causing the clutch wheel M to bind against the flange E and against the flange D, according to the direction in which the lever is thrown. In this manner the vehicle is made to run backward or forward, as desired, but with different speeds, as the friction clutch flanges D and E are different in size.

It will be seen that to each of the cylinders H is secured a pair of hollow trunnions, T, on opposite sides of the cylinder, these trunnions having a bearing in the housing, as shown at U, such bearings being preferably bored out, as particularly seen in Fig. 2. Inlet and outlet passages, W and V, respectively, extend through the casing into these bearings and into other ports, 3 and 4, in the trunnions and cylinders, the passages W acting to convey the expansive medium into the engine cylinder, while the passages V act to convey such medium from the cylinders after it has been used therein to operate the pistons. In each of these cylinders is mounted a suitable piston, X, which is connected with a crank, N, formed in the crank shaft I. Suppose that one of these pistons is at its innermost position. While in such position the operating medium enters the inlet port W and passes through the passage 3 in one of the trunnions T into the engine cylinder beneath said piston. This will cause the piston to immediately make its outstroke, so that the crank shaft will be rotated. By reason of this rotation the cylinder is rocked on its trunnions T, and the inlet passage 3 in one of said trunnions is cut off, so that the operating fluid may expand to give up the larger portion of its energy. As the crank shaft is still further rotated the cylinder will be rocked to such a position that an exhaust port, 4, extending through the other of said trunnions T, will match with the exhaust port V, so that the pressure fluid may be exhausted before the cylinder takes in another charge. Thus it will be seen that the trunnions of the cylinder itself cut off the inlet port and open the exhaust port, and vice versa. The times of cutting off these ports are properly related, so as to derive the best results from the pressure fluid. Thus the inventor claims to do away with valves, eccentrics, etc., commonly employed in engines. As shown in the drawings, the cranks are preferably formed at an angle to each other, so that they will operate at different times to drive the crank shaft, and thereby the vehicle.

Upon the shaft A or axle shaft are mounted two flanged wheels, 5 and 6, one of which is smaller than the other and is a short distance from the other. The interior of the flanged wheel 5 is beveled outward, as shown at 7, while the exterior of the wheel 6 is beveled toward the wheel 5, as shown at 8. A double tapered roll, 9, is slidingly mounted upon the crank shaft I and is held from rotating independently of the crank shaft by means of a spline, 10. About midway between the ends of this tapered roll is formed an annular groove, 11, within which fits one end of the pivoted lever 12, supported in any suitable manner. This lever is adapted to throw the double tapered roll, which constitutes the second member of the clutch, either into engagement with the interior of the wheel 5 or into engagement with the exterior of the wheel 6.



When this roll is in engagement with the wheel 5 the vehicle is driven in one direction, and while in engagement with the wheel 6 it is driven in the opposite direction, but with the same speed, as the end of the roll 13 is smaller than the end 14, and the clutch wheels are properly proportioned to give this result. When this form of clutch is used the housing G may remain stationary.

In the drawings two simple engines are shown connected with the crank shaft, but in some instances, where very heavy loads are to be hauled and where the vehicle is to be used in hilly countries, three or more of such engines may be employed, so that there will be no possibility of the vehicle stopping by reason of the crank getting over the dead center. The housing forms an air-tight compartment, so that it may partly be filled with oil in order that the trunnions and pistons may be thoroughly oiled. The crank shaft always travels in the same direction, the vehicle being driven forward or backward through an improved friction device.

No. 644,590—Motor Vehicle.—Hiram A. Frantz, Tamaqua, Pa., assignor of one-half to Elmer E. Brode, of same place.

Fig. 1 is a side view, partly in section, of a machine embodying my improvements. Fig. 3 is a horizontal sectional view of the axle casing and differential gear, and Fig. 3A is a vertical sectional view of one of the front wheels and its connection to the axle and casing. Figs. 4, 5, 6 and 7 show various parts in detail.

No. 644,853—Motor Vehicle.—Eugene Fahl, St. Louis, Mo. Application filed July 3, 1899.

Fig. 1 is a side elevation. Fig. 2 is a plan view of the framework and gearing. Fig. 3 is a view in perspective of the steering and controlling levers. Fig. 4 is a view in perspective of one of the springs.

In the construction a rectangularly bent frame, 1, is made use of, the forward portion of which is slightly higher and narrower than the rear portion, and the forward ends are each provided with a pair of vertically arranged bearings, 2. Formed in the rear end of the sides of the frame 1 are the oppositely arranged bearings 3, in each of which operates a short shaft, 4, which shafts together perform the function of the rear axle of the vehicle, and on the outer ends of the shafts are arranged the rear wheels 5, there being large gear wheels 6 fixed upon the inner ends of said shafts.

Rotatably arranged in the vertical bearings 2 are shafts 7, integral with the lower portions of which are formed coil

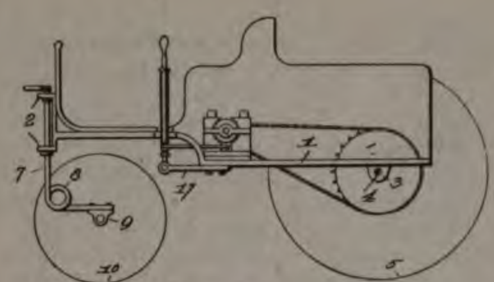


FIG. 2.

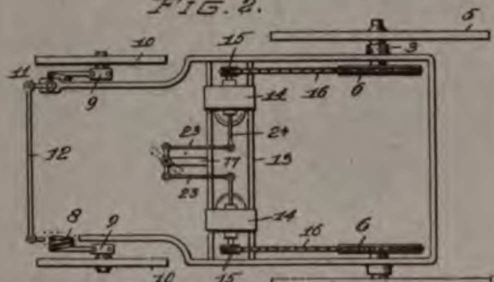
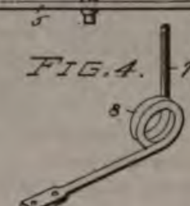


FIG. 3.

FIG. 4.



springs, 8, and the ends of said coil springs are extended rearwardly a short distance, and journal bearings, 9, are secured to the rearwardly bent ends. In the journal boxes 9 are rotatably arranged the stub axles on which the front wheels 10 of the vehicle are arranged. Short crank bars, 11, are rigidly fixed upon the upper ends of the shafts 7, which crank bars extend forwardly, and their ends are connected by the cross bar 12, thus providing means for causing the shafts 7 and front wheels to move simultaneously.

Mounted upon the cross bars 13 in the frame 1, adjacent each side thereof, is a motor, 14, upon the shaft of each of which motors is fixed a small pinion, 15, there being a sprocket chain, 16, passing around each of said pinions 15 and from thence to the gear wheels 6.

Fulcrumed to a bracket, 17, at the center of the frame 1 is the lower end of a vertically positioned operating handle, 18, the same extending upwardly through the vehicle, and upon said handle, a short distance from the lower end thereof, is fixed a collar, 19. This operating handle extends upwardly just in front of the seat of the vehicle, and rotatably arranged upon the upper portion of said handle above the collar 19 is a sleeve, 20, there being an operating handle, 21, projecting laterally from the upper end of said sleeve.

Fixed to and projecting laterally from each side of the lower end of the sleeve 20 are the arms 22, to the outer ends of which are pivotally connected the rods 23, which extend rearwardly a short distance and are pivotally connected to the rheostat arms 24 of the motors 14.

No. 645,044—Gas Engine.—Albert T. Otto, of Chicago, Ill., assignor to Robert L. Stevens, of Hoboken, N. J.

In the drawings, Fig. 1 is an elevation with the valve chests in section. Fig. 2 is a section through the cylinder and parts at right angles to Fig. 1. Fig. 3 shows a modification of one of the valve chests. Fig. 4 is a partial sectional plan at the line x x, Fig. 2; and Fig. 5 is a section of the supply pipe and chamber at the line y y, Fig. 1.

The frame A is of suitable size and shape, and to it is connected the cylinder B, and the crank shaft C is supported in suitable bearings D upon the frame A, and the connecting rod E extends to the piston F, where it is received between the lugs 3 and receives through it the connecting pin 4. This piston F is to be of any desired character, except in the parts hereinafter named.

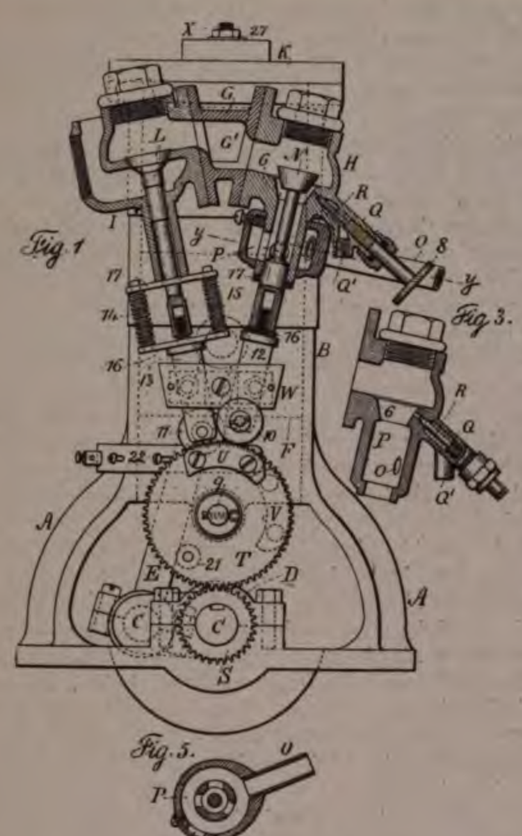
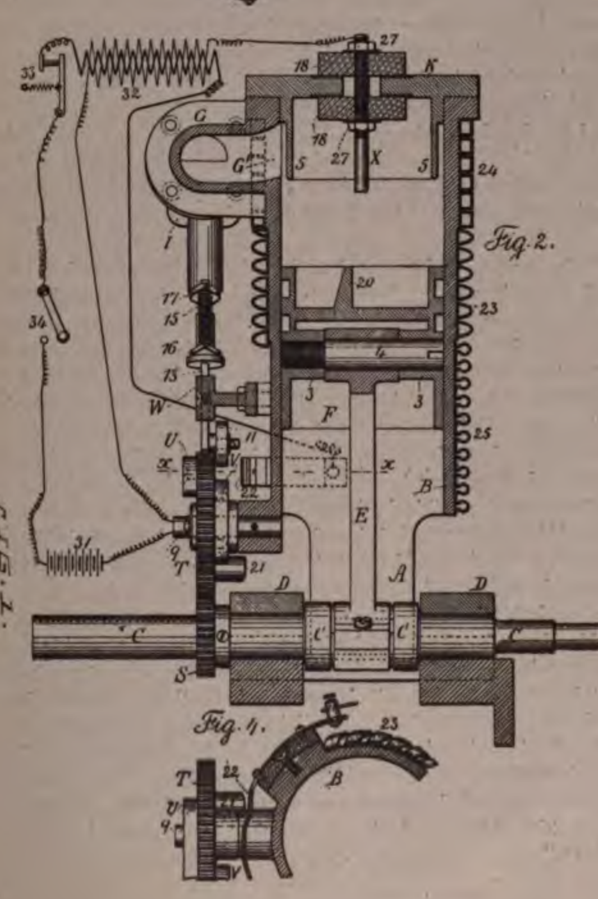
At one side of the cylinder B is a hollow projection G at the port or opening G′, leading into the cylinder, and the valve chests H and I are connected to the flanges at the sides of the projection G, which flanges are inclined to each other, so that the axial lines of the valve stems will be on radial lines extending to the actuating wheel T, or nearly so, and the chest H is for the induction valve and the chest I for the eduction.

The cylinder head K is bolted on to the flanged end of the cylinder, and it is provided with an annular deflector, 5, in the form of a comparatively thin cylinder projecting from the head K into the cylinder and extending as far as the opening or port G′ in the projection G, and there is a space between this deflector and the interior surface of the cylinder, so that the air and gas or vapor passing into the cylinder through the port G′ strike against this deflector 5 and pass around the cylinder at the same time that they pass into the cylinder at the edge or end of the deflector.

The action of the parts thus far described is that as air and gas or vapor pass into the cylinder they strike against this deflector 5, and such deflector, being in a highly heated condition, raises the temperature of the air and gas so that it is in a better condition for perfect combustion, and when the explosion takes place the force of that explosion is largely concentrated upon the interior surface of such deflector, tending to increase the heat of the same, and at the same time lessen the heat given to the cylinder itself, and as the heated products of combustion pass away from the cylinder they impinge upon this annular deflector, still further increasing the temperature of the same, and in the projection G′ a similar operation takes place—that is to say, the heated gases passing off through the port G′ impinge against the interior of the projection G and heat the same—and the air and gas or vapors, when they pass in through such projection laterally from the induction valve chest, impinge against the surface of such projection and become heated and lessen the heat of the cylinder and port. Thereby there is an interchange of the heat, tending, on the one hand, to fit the gaseous materials for perfect combustion or explosion, and, on the other hand, to reduce the temperature of the cylinder and thereby lessen the risk of the lubricating material employed with the piston becoming carbonized.

The exhaust valve L opens inwardly, and there is an escape port or pipe for leading away the gases, and the induction valve N also opens inwardly, and it rests upon the seat 6 when closed, and the stems of the valves L and N occupy radial or nearly radial positions to the actuating wheel. Where air and gas mixed together are employed, the same are advantageously supplied by a pipe, O, which may be flexible, and the same opens into the mixing chamber P that surrounds the valve stem. This mixing chamber P may be separate, as indicated in Fig. 1; but the inventor prefers to have the valve chest and mixing chamber in one, as seen in Fig. 3, and there is an opening at 7 through which air may be admitted; but when air and gas are supplied by the pipe O this opening 7 will usually be closed by a cap or plug.

In the pipe Q is a valve R, which is advantageously in the form of a pointed screw stem, having a head, 8, outside the end of the pipe Q, by which the valve can be adjusted, and the lateral branch Q′ to the pipe Q serves for the supply of naphtha, gasoline or similar material, which should be under sufficient pressure to cause it to pass through the hole in the valve seat in the form of a jet that is more or less atomized by the action of the air, so as to commingle therewith and be in the proper condition for explosion within the cylinder

of the engine. The screw stem and valve being directly in the line of the hole in the valve seat, also keep such hole free from any obstruction.

Rollers, 10 and 11, are provided upon slides, 12 and 13, in the stationary guides W for the cams U and V to act upon the rollers and move the slides, and the slides are connected with the respective valve stems, and the springs 14 and 15, intervening between the cross pieces 16 at the ends of the slides and the cross pieces 17 adjacent to the respective valve chests, act to close the valves rapidly as the cams pass out of contact with the respective rollers.

In consequence of the valve chests H and I having similar flanges that are bolted upon the inclined opposite sides of the hollow projection G, the positions of these valve chests can be transposed to cause the engine to run in the reverse direction, and the valves and their stems being in the same perpendicular plane to the crank shaft, the parts are kept close to the cylinder, so that the fly wheel is not at a distance from the bearings D.

Any desired source of electric energy can be connected to the central insulated electrode X and also to the cylinder of the engine.

Radiators are used around the cylinder. These radiators are in the form of metal wires or strips projecting outwardly from the cylinder and setting closely at their inner portions against such cylinder, so as to convey away the heat by conduction from the cylinder and to disperse it by radiation from the projecting coils or open loops.

I find it advantageous to employ wire wound up into rectangular or nearly rectangular helices, 24, and drawn around the cylinder and held in position so that one flat portion of each helix sets closely against the surface of the cylinder and the other portion of such helix projects as a loop, and there are openings between these respective loops or projections, so that the air has an opportunity to circulate, and the heat that is conducted from the cylinder is dispersed both by radiation and by the convection of the air circulating through the openings in the radiators. These radiators are shown at 23 as flat on one side and arched on the other side and at 25, as in the form of loops with compound curved sides.

It will be apparent from the diagrammatic illustration of the electric circuits appended to Fig. 2 that when the contact stud 21 upon the gear T touches the insulated plate 22 the primary circuit of the inductorium 32 will be closed and the pulsator 33 therein will make and break the primary circuit; but the spark will not pass from between the central electrode X and the stud 20 until the latter approaches the stationary electrode and is sufficiently near for the spark to pass from one to the other, and by this arrangement the time of ignition is rendered very reliable, although the stud 21 may remain in contact with the plate 22 after the crank has turned the center and the piston moves in the other direction, and the numerous sparks passing between the electrodes as the armature of the inductorium vibrates will insure the explosion.

In consequence of the annular deflector 5 being in a position where it is liable to become highly heated by the explosion and the issuing products of combustion, the same is claimed not only to promote a perfect combustion of the heated air and gases, but under some circumstances to effect an ignition of such gases at the moment of the greatest compression of such gases upon the return stroke, even when the wires to the battery are disconnected.

"A Plea for Good Roads."

"A Plea for Good Roads in New York State" is the title of a little pamphlet issued by the Automobile Club of America, containing the addresses delivered at the Good Roads meeting of the club in February.

The speakers on that occasion were: Albert R. Shattuck, chairman of the good roads committee of the Automobile Club; Gen. Roy Stone, of the Office of Road Inquiry, Washington, D. C.; Edward A. Bond, State Engineer of New York; H. I. Budd, State Road Commissioner of New Jersey; E. J. Harrison, of the Office of Road Inquiry, Washington; J. C. Mendenhall, of the Massachusetts Highway Commission, and Isaac B. Potter, prominently identified with the League of American Wheelmen.

In his opening discourse Mr. Shattuck spoke of the contention made in America and nowhere else in the world that superior railway facilities render improved highways unnecessary. He said:

"This is absurd. Every pound of freight which is carried by the railways, except such as is loaded at factories, quarries, mines, etc., at side tracks, must first be carried over our highways. Every passenger who travels on the railway must, to reach the railway, first pass over some portion of the highways. It can safely be said that the highways of this country carry more passengers and more freight than the railways, but, of course, for a shorter distance."

He showed that Massachusetts, New Jersey and Connecticut had spent sums ranging from $1,289,000 to $3,137,000 in road improvement, while the great State of New York has expended less than $160,000 in the same cause, and this notwithstanding the passage of the Higbee-Armstrong bill authorizing the Legislature to appropriate half the cost of road improvement, provided the other half of the expense were assumed by the counties and towns where the improvements were made. Petitions for the improvement of 676 miles of highway have been received by the State Engineer, but the Legislature has failed to make the necessary appropriations.

"It has been estimated," he continued, "that there is something more than $3,000,000 a year spent in the State of New York in repairing the highways. The usual method of repairing roads is to plow up a ditch and scrape the silt, grass and roots which are there up on the road. The first time there is a hard rain much of this goes back into the ditch, and a very large part of this annual expenditure of over $3,000,000 is simply money thrown away."

Gen. Roy Stone, who has had a most interesting experience in making bricks without straw, or, in other words, making good roads without money, spoke of the new hope for the cause of good roads in the accession of the powerful automobile interests.

"The accession of your organization," he said, "and all the powerful business interest behind it to the forces heretofore working for road improvement forms an era in the history of the cause. It is a growing and a widening effort all over the United States, but it has lacked the co-operation of great business organizations, and, to some extent, the direction of trained business minds. These you will bring to it, together with great command of capital, which has always been wanting for its development. It is incredible how much has been done with so little means, and it is therefore incalculable how much can be done with the great means which I trust you can bring to bear on the work. I would be glad if I could trust myself to advise you as to the line of action you should best take in promoting road improvement. It would seem as though you might wisely take up some of the larger problems which we have considered, but which were beyond the means at our control. In this great country it is often easier to do big things than small ones. You have only to catch the public fancy and stir up public sentiment, and unlimited means are placed at your disposal.

"There are three great enterprises in connection with the good roads work, any one of which is worthy of your consideration.

"Three years ago, when the price of steel rails was below a cent a pound, we were on the point of success in introducing the general use of steel track, but for the lack of $2,000 or $3,000 to pay for new rolls to make special shapes of rails we were compelled to patch up our specimen tracks from shapes already in the market, and thus failed to make them successful or attractive. When steel comes down again to normal value, it becomes the logical and necessary road material.

"All the consideration of easy traction, cheap maintenance and even of moderate first cost are in its favor. It will be especially valuable for your vehicles in saving the wear and tear of one of the most costly parts—the rubber tires. Your vehicles are distinctly road improvers, but on stone roads they do it with much cost to themselves. It is not necessary to wait for the former price of steel to make the practical tests necessary, and I therefore earnestly recommend that you give some aid to the Division of Road Inquiry at Washington in this direction.

"A second great departure which many of us have advocated looks to the provision of vast sums of money at very low rates of interest for the general construction of highways throughout the country. It involves the establishment of postal savings banks and the loan of their funds on county bonds issued exclusively for road improvement and guaranteed by the State, the rate of interest to be no more than that paid by the Government on deposits, possibly 2 per cent., the Government gaining its compensation in the improvement of the highways and the better and cheaper transportation of the mails.

"The campaign for postal savings banks is already half won, and the only serious drawback to it is the difficulty of a lack of the proper investment of the funds. No investment could be safer than that in public roads, which adds at least tenfold their cost to the value of property which is pledged for the debt. The small interest charged could in most cases be taken out of the present amount of road taxation and still leave enough to keep good roads in good order, so that the result of good roads everywhere would be brought about without a perceptible increase in taxation, while their benefits would be accompanied by that increase of rural thrift and economy which would result from an extension to all the agricultural regions of Government savings institutions and the saving habit."

He also advocated the building of a great national highway, to stretch across the continent from one ocean to the other.

"A project so vast," he concluded, "may seem like a vision of dreamland, but in all its vastness it is only a fraction of what already has been done in the construction of our continental railways, and it is no more than a fitting adjunct or sequence of the great transformation of travel which the successful advent of the automobile has wrought for the future."

Mr. Bond submitted a large amount of practical data gleaned from his experience as a State engineer in charge of road building. He said that he had found a 15 or 16 ft. width of macadam best, and that the average cost per mile throughout the State would probably be about $8,000.

New Jersey is an excellent example of what combined agitation for good roads can accomplish. Since the State Aid law was enacted in 1891, through the efforts of the more progressive farmers and the bicycle riders, more than $2,000,000 have been spent in road improvement resulting in 440 miles of excellent highway. All opposition to the plan has passed away, and now petitions for 500 miles more of good roads are on file. The farmers in particular have seen the benefits to be derived from this source in the increased values of their property and produce and the added comfort and happiness that easy transportation gives to a rural community.

The State Aid Act recognizes the fact that the roads belong to the general public, irrespective of where they live, and that it was not right for local authorities to be taxed for the roads which are largely used by people traveling long distances. So it provides that when the property owners along a certain road desire its improvement, two-thirds of them shall petition the freeholders for the same, agreeing to pay 10 per cent. of the cost. This petition, if accepted by the freeholders, and the specifications approved by the State Commissioner, requires the State to pay one-third, and the county the balance of the cost. This has worked so well in practice that other States have copied its main provisions.

Referring to State aid in general, Mr. Budd, the representative of this State, said:

"State aid is absolutely necessary for the improvement of roads. No great system of road building has ever been inaugurated without the State being the initial point, and in no other way will our roads become generally improved. It is truly said that the common wagon roads are the greatest highways of commerce. Upon them all raw products must first move. Over them are carried many times more tons of freight than other means of passage combined. Therefore it is a surprise that the greatest energies of all the States should not be first devoted to their improvement. It should be the political text of all our people that each and every one of our representatives should devote their first talent to the raising of ways and means by which our wagon ways shall be made smooth and hard. Our legislators, under extreme pressure, make a show of moving in this direction, but they are entirely too slow. They hold out the promise, but, with few exceptions, do not furnish the necessary means, yet are willing to waste millions in other directions that do not work directly for the public weal."

Mr. Harrison went into the history of road building in this country, and showed how the introduction of railroads and the tremendous impetus given to their construction from 1830 to 1870 had put a stop to road building, until about five years ago the subject was taken up again, and would receive greater attention than ever. He gave many interesting practical examples of the advantages of good roads to the farmers in the better prices for their produce and accessibility of markets. He also touched on the improved postal facilities enjoyed in communities where good roads abound.

The palm for good roads appropriations is borne off by the State of Massachusetts, which has spent over $3,000,000 for this purpose during the past seven years. A commission of three members was appointed about six or seven years ago, at first merely an investigating commission, but which afterward became a constructing commission. The topography of Massachusetts differs very much from that of New York and of New Jersey, and the supply of material is, of course, different from that of other States, so the whole road building problem of Massachusetts is different from what we find in New Jersey or in New York. The system which has been adopted is not that of the improvement of every highway. Dr. Mendenhall said: "We believe that it is wise, at least for Massachusetts, to construct in the very best possible manner, at the highest necessary cost—that is, at a high cost if necessary—a system of public roads; that that system shall be distributed over the Commonwealth so it shall always be within easy reach of any part of the Commonwealth, and we have not and do not attempt to remake a very large percentage of roads in the State.

"We have in the Commonwealth of Massachusetts in all, including city streets, about 22,000 miles of roadway—20,000 miles, perhaps, excluding city streets. We have followed the example of some of the European nations that have had much experience and given a great deal of study to this subject, especially France and England, and one or two others I might mention, in reaching the conclusion that the great public road constituted about 10 per cent. of all the highway of the Commonwealth. For instance, the national roads of France—those maintained by the nation—constitute about 10 per cent. of the entire system of roadway. Our scheme, therefore, in Massachusetts implies the final improvement of about 2,000 miles only of highway in that Commonwealth. Now, if I had a map—which I did not even think to bring with me—I would be glad to show you what 2,000 miles of roadway will do when properly distributed over the State of Massachusetts. Massachusetts is not a very large Commonwealth, except in certain particulars which modesty will not allow me to refer to here, but if you distribute this 2,000 miles as we have done over the State, you will find there will scarcely be a farm or corner of the State which will not be within 2 or 3 or 4 or, at most, 5 miles from this great system of State highways, and we expect that the local roads connecting these more remote localities with the great system will be improved, and, in fact, many of them have already been improved and connected with our system by the local people.

"In Massachusetts the money is provided by the State. It is true that 25 per cent. is afterward returned by the county in which the roads are built, but the original payment of the cost of road construction is by the State at large. We have already expended over $3,000,000, and we have built somewhat less than 300 miles of road, so the average cost of our roadway in Massachusetts is somewhat over $10,000 a mile; but we expect to be able to reduce it in a year or two to about $10,000 a mile or less. In Massachusetts we have much heavy grade work to contend against, and a great many streams and brooks, and we have to build bridges and culverts, and this cost I speak of includes the entire cost of the road construction.

"A few facts in regard to the nature of the roads may be of value. We build our roads mainly of macadam. We have built six or eight miles of gravel out of 270 or 275, the total mileage up to this time. We have not yet found—although we would be glad to do so—a gravel road to be a very satisfactory road, especially where there is considerable traffic. Where the traffic is small it seemed to do well, but we have found that it costs nearly as much to build a gravel road as it does to build a stone road. When you spend as much

money as you must in grading and drainage and culverts and all of the things that must go with the road except the mere surface, then you do not gain so much by simply using gravel instead of broken stone, and, as broken stone is so much more lasting and better in every way than gravel, we have mostly used it. Our roads are macadamized 15 ft. wide, with an extension of 3 ft. on each side, making a travelable way of 21 ft. We limit the grade of our roads to 5 per cent.; we have occasionally, however, to raise it to 6 or 6½ where our hills are so long and steep that it would be extremely costly to reduce them to a 5 per cent. grade. We pay great attention to removal of water, which is the great curse of the public road, as everybody knows, doing a great deal of drainage, side draininge, using telford a great deal and putting down drain pipes on both sides—in fact, about half of the $10,000 per mile that I speak of is underground in our roads; half of it is not visible, so that the surface part, which people mostly see, and which they only see, represents about $5,000 or $6,000 of the total $10,000 which is spent. We put more stone upon our roads than is the practice of some of our friends who have described their roads to you to-night. Our standard road is 6 to 8 in. of stone after it is rolled. We put the stone down in three different sizes, in three layers, which is a practice much condemned by some road builders, but highly approved of by us after considerable experience in both systems, and each course is rolled very thoroughly by a 10-ton or 12-ton roller as it is put down, so in the end we have a solid stone pack of 6 or 8 in. thickness, and, if necessary, with telford 6 or 8 in. underneath. Our masonry work in bridges and culverts is as good as can be made. I think our system is expensive because we purposely make it so. We find it is not wise for the State of Massachusetts to build roads that will have to be repaired a very great deal within a few years. We believe what is worth doing at all is worth doing in the best possible way, and we invite you to take the first opportunity to examine the system of roads which is gradually stretching itself from one end of the Commonwealth to the other."

The appropriations for this building amount to from $500,000 to $800,000 a year.

Isaac B. Potter recommended an appeal to the New York Legislature for immediate appropriations to carry on the work of road improvement which is in the interests of the people and is desired by the people.

Two Electric Vehicle Tests.

An electrical engineer who has investigated the motor vehicle question quite thoroughly had occasion some time ago to make some tests with the object of determining the traction energy of an electric vehicle or the amount of current required to drive a vehicle of a given weight at a given speed. The tests were made with a Schaefer & Budenberg tachometer on the level boulevards of the Boston park system, which are ideal roads for the purpose. The results show the same discrepancy between the manufacturer's statements and the experience of the road that has been from the start characteristic of electric vehicle manufacturers.

In the first test the batteries were of the 11 E. 250 ampere-hour Chloride type, the tires were of steel, special chain, fine cut sprocket, and ball bearings were used. Under full load the motor made 550 revolutions per minute, developed 7½-h.p. and gave a brake efficiency of 89 per cent. A single reduction gear carried the power to the axle. The following table shows the figures:

Test No. 1.

Speed.	Amperes.	Volts.
1..... 4 miles per hour	65	20
2..... 8 miles per hour	72	38
3.....16 miles per hour	95	70

Power per ton at above speeds:

1.— 480 watts × 60 per cent. = 288 watts.

2.—1012 watts × 70 per cent. = 784 watts.

3.—2500 watts × 75 per cent. = 1900 watts.

The second test was made with one of the earlier Columbia runabouts, weighing 1,900 lbs. and having a nominal 2-h.p. motor weighing 129 lbs. The carriage weighed 920 lbs. and the batteries, consisting of 44 cells, weighed 850 lbs. According to the manufacturers, the power required to drive the carriage at 12 miles an hour was 1,050 watts and the total efficiency of the motor was 70 per cent.

Three-inch pneumatic tires and ball bearings were used. The result of the second test showed that the power required to make a speed of 12 miles an hour was 22 amperes and 80 volts, or 1,760 watts. The carriage was practically new and was under the skilled care of an expert electrician.

Power per ton at 12 miles per hour:

$$1900 + 300 = 2200 \text{ lbs.}$$

$$\frac{20}{22} \times 1760 \times 70 \text{ per cent.} = 1120 \text{ watts at the wheel rims.}$$

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

ALUMINUM • CASTINGS.

Try our new alloy. It is of beautiful silver whiteness, light, strong, easily machined, and reasonable in price.
Intricate Castings a Specialty.

THE ALUMINUM CASTINGS CO.
HYDE PARK, MASSACHUSETTS.

FOR SALE.

A second-hand Winton phaeton; just from the works, in perfect running order; will give trial. Only selling to purchase another carriage of same make, but with more power, to use in another part of the country where roads are heavy and grades steep. Price $750. Apply Adams, No. 57 West 66th Street.

SPECIAL *TURNED METAL PARTS FOR AUTOMOBILES. Made to order from sketch or sample.* : : : : : : : : : :

DODGE MACHINE SCREW CO.,
BOSTON.

Seamless Cold Drawn Steel Tubing, Shells, Cylinders and Tanks, For Air, Gas, Steam, Ammonia or fluids under pressure and explosives. ☞ Seamless Steel Tested Tanks of Sundry Diameters.

DROP FORGINGS AND STEEL STAMPINGS.
JANNEY, STEINMETZ & CO., Drexel Building, Philadelphia, Pa.

STEAM VEHICLE FITTINGS.

PIN Valves (both union and plain ends), Injectors, Gasoline Regulators (improved type), Water Regulators, Improved Glass Gauges, Globe and Check Valves, Water Relief Valves for Cylinders, Steam Gauges and Safety Valves.

LOCKE REGULATOR CO., - - Salem, Mass.

WANTED.

A Locomobile, Style No. 2. State price and condition.
G. E. SLEEPER,
1395 Main Street, Hartford, Conn.

ELECTRIC IGNITION

IN GAS, GASOLINE AND OIL ENGINES.

We make special SPARKING POINTS for this service possessing extreme hardness and greater durability than platinum.

SEND FOR DESCRIPTIVE MATTER AND PRICES.

BAKER & CO., Manufacturers of Platinum Products,
NEWARK, N. J.

THE JUMP SPARK LEADS
Give Thick
1 Inch Jump Spark.
Weight, 8 lbs.
Dimensions, 8x4x4 ins.
Patent Applied For.
C. F. SPLITDORF, ELECTRICAL SPECIALTIES,
21 Vandewater St., New York.

Drive Chain,
SPROCKETS.
GEARS. 3,200 Sizes.
Compensating Gears.
Steel Balls, etc. . .
Boston Gear Works,
138 Purchase St.,
BOSTON, MASS.

Engines, Boilers and Burners
FOR...
STEAM VEHICLES.
MILNE & KILLAM,
10 CRESCENT ST., EVERETT, MASS.
SEND FOR CATALOG.

...ASHTON...

Pop Safety Valves, Cylinder Relief Valves, Steam Gauges, Automatic Water Gauges and Gauge Cocks for

STEAM VEHICLES.

THE ASHTON VALVE CO., 271 Franklin St., Boston, Mass.
BRANCHES: 121 Liberty Street, New York.
1218 Filbert Street, Philadelphia.
218 Lake Street, Chicago, Ill.

Automobile Storage and Repair Co.

Station No. I—57 WEST 66th STREET (St. Nicholas Rink Bldg.), NEW YORK.

House and Care for Automobiles of all kinds. Storage Batteries Charged and Supplies of all kinds furnished.

Transients Accommodated.

BALDWIN DETACHABLE AUTOMOBILE CHAINS

are made in sizes to suit the demands of the trade. Our new roller chain is especially adapted for light Motor Vehicles.

SEND FOR CATALOGUE.

K. FRANKLIN PETERSON, Sales Agent,
205 Lake St., Chicago, Ill.

BALDWIN CHAIN CO., WORCESTER, MASS., U. S. A.

CHAS. F. SCHAEFFER, 811 Drexel Building, PHILADELPHIA, PA.
DRAUGHTSMAN AND MACHINE DESIGNER.

Any of our subscribers who are willing to solicit subscriptions for THE HORSELESS AGE from their fellow townsmen are requested to communicate with the Editor, as we are desirous of entering into business relations with such parties.

VALUABLE PATENT RIGHTS AND DESIGNS For Automobile and Boat Engines and Running Gears and . . . . Accessories for Automobiles . . FOR SALE.

AT A REASONABLE PRICE FOR ENGLAND, GERMANY AND FRANCE, SINGLY OR TOGETHER.

THIS is not a scheme to unload undesirable property but is an honest and legitimate offer; because the party desiring to make the sale feels that the American field is amply sufficient in which to operate himself. Close and Business-like **Investigation is Solicited,** and no letters will be answered that are not accompanied by references in regard to character and financial standing, which can be quickly investigated from New York City without prolonged correspondence. It is desired to get in touch with manufacturers of standing, or reliable and responsible capitalists who wish to embark in this line of work.

ADDRESS—"K," CARE OF THE HORSELESS AGE COR NASSAU AND SPRUCE STS., NEW YORK CITY, U. S. A.

VOLUME FOUR COMPLETE. (April 5th to September 27th, 1899, inclusive.)

To New Subscribers for Two Years.

We wish to place these volumes in the hands of persons permanently interested and therefore offer them only to those who will subscribe for two years from April 5th, 1899. :: :: ::

SEND $4 AND GET THIS VOLUME BEFORE IT IS EXHAUSTED.

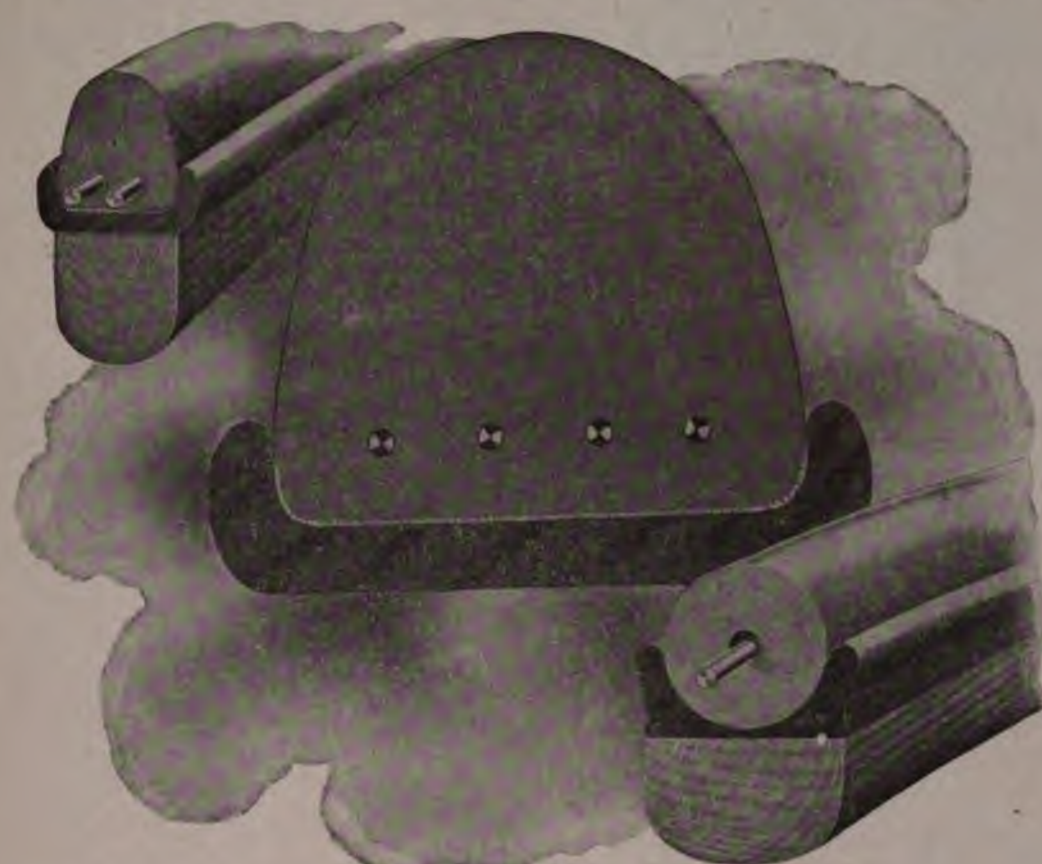
SHELBY STEEL.. TUBING

IS Cold Drawn, from high carbon, Open Hearth Steel.

Surfaces are clean and smooth, inside and out.

The best production possible, by the latest and most improved methods known.

PRICE LIST "E" AND SAMPLES FOR THE ASKING.



STEAM IS THE BEST POWER FOR AUTOMOBILES

Steam Motor Wagon.

THIS STYLE NOW READY.

OTHER STYLES TO FOLLOW.

THE Carriage illustrated here is one that will satisfy the most critical, for in it is combined the finest carriage work and the best machinist skill and workmanship, and it is the most practical and satisfactory pleasure carriage one can have.

FOR FULL PARTICULARS AND PHOTOGRAPH ADDRESS

STANLEY MANUFACTURING CO.,

No. 117 LINCOLN STREET, BOSTON, MASS.

DIAMOND TIRES...

DIVIDE YOUR ORDERS

WE DESIRE COMPARISON

OUR CONSTRUCTION ORIGINATED WITH US

IMITATORS OFFER INDUCEMENTS IN PRICE

RESULT WE LEAVE TO YOU

DIAMOND RUBBER COMPANY

AKRON O.

THE HORSELESS AGE.

EVERY WEDNESDAY.

DEVOTED TO MOTOR INTERESTS.

VOL. V. NEW YORK, MARCH 21, 1900. No. 25.

THE HORSELESS AGE.

E. P. INGERSOLL, Editor and Proprietor.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET, NEW YORK.

SUBSCRIPTION, FOR THE UNITED STATES AND CANADA, $2.00 a year, in advance. For all foreign countries included in the Postal Union, $3.00.

COMMUNICATIONS.—The Editor will be pleased to receive communications on trade topics from any authentic source. The correspondent's name should in all cases be given as an evidence of good faith, but will not be published if specially requested.

☞ One week's notice required for discontinuance or change of advertisements.

THE HORSELESS AGE, 150 Nassau Street, New York.

Entered at the New York post-office as second class matter.

On account of the excessive discounts charged by New York banks on small checks under their new rule, subscribers are requested to remit by Post Office or Express money order or N. Y. draft.

Anglo-Americans on Furlough.

It looks as though the transatlantic contingent of the Anglo-American scheme had been given a furlough, if not a discharge. The warm reception which was accorded them here probably brought on an attack of homesickness and they have returned to the original scene of their operations in London. Since the Hon. J. Scott Montagu took occasion to tell what he thought of Pennington, Lawson and their ilk before the Automobile Club of Great Britain it will be strange if the ears of these pachydermous promoters do not tingle before they reach their destination. As to what will happen when they arrive at London, perhaps the honorable defender of industry gave some inkling in his paper when he said that such men should be shunned like a pestilence. But how about the pestilence they left behind them on this side? Does a $75,000,000 motor vehicle promotion scheme become less chimerical because a few objectionable individuals connected with it have been relegated to the background? It is the thing itself that is censurable, and a change of personnel does not alter it.

Advancing Prices.

Our London correspondent informed us last week that the leading English motor vehicle manufacturers had made a general advance in prices. The increase was described in part to the greater cost of material and labor in all Christendom since "good times" materialized, but it is also admitted that the margin of profit originally figured was found altogether too small in practice if the quality of the product was maintained.

This action on the part of experienced foreign manufacturers affords another illustration of the truth of the assertion often made in this column that the tendency among motor vehicle makers the world over has been to underestimate the cost of their vehicles, to plunge into the business with more enthusiasm than discretion and establish false standards of values, both for themselves and the public. The disillusionment comes when the annual statements are published, and the necessity of closer estimates of cost of production and more rigid economy in management is then recognized. It is better, however, that this should be recognized at the start and such mistakes avoided. Count the cost carefully. A good article commands a good price.

Journalistic Degenerates.

The Tripler liquid air promoters have been literally riddled with criticism by the technical press since they attempted to float their $10,000,000 scheme to oust the steam engine from the world and propel all kinds of vehicles and boats with their illusory agent. It is worth noting that advertisements of this character invariably appear in the daily press, whose

editors carefully refrain from comment on the outrageous claims made therein while the advertisements are running. Hence the great body of the unscientific public, in whose eyes there is a certain sanctity about anything printed, are without aid or guidance in determining the value of advertisers' claims. Unfortunately, some technical journals take too lenient a view of this matter and are satisfied to accept advertisements which they must know to be deceptive and misleading, detrimental to the ultimate interests of their clientele as well as to the public at large. This we believe to be false policy, an infallible sign of degeneracy in a publication. Judged by this standard, journalistic degenerates are numerous enough to appal even a Lombroso.

That Klondike Canard.

The poor automobile! What a host of humbugs, canards and nonsense of all kinds it is responsible for! Now comes one Jean de Marre, fresh from Paris with an automobile, by means of which, the newspapers tell us, he intends to reach the Klondike gold fields, starting out from Dawson City and following the Yukon River to the interior. The Quixotic gold hunter has provided himself with special spiked tires and runners, which he can use for slippery hills and icy steppes, and will also take with him a canoe. So the story reads.

We know nothing of the Klondike gold fields from experience, but from the accounts we have read of the routes by which it is reached we have very grave doubts of the practicability of the ambitious Frenchman's plan. The road is extremely rough and we very much fear that the machine would prove unequal to some parts of it. Then there is the danger of serious breakages in such unbroken country, without means of proper repairs, and the scarcity of fuel and water, which will be likely to lay the machine up in some desolate spot in the vast Northern Sahara of ice and snow. Such reflections as these quickly remove the glamor from this romance of reaching the Klondike by automobile.

Bicyclists and Motorists Part Company.

The L. A. W. has decided to work independently of the Automobile Club in the Good Roads movement, confining itself to the construction of side paths and making Good Roads a subordinate issue.

According to Chief Consul Belding, the reasons for this failure to harmonize are the following:

The fact of there having been 167,050 side path license tags sold since the law was passed last March is a sufficient evidence that the wheelmen want the paths and are willing to pay for them rather than to wait years for good roads. In the second place, the hard roads will soon be overcrowded with automobiles running at the rate of 20 to 30 miles an hour, which will make the highways unsafe for wheelmen until the road builders have learned to build much wider and better roads.

The decision is not surprising. We have never had any faith in the attempt to affiliate old and new trades. The bicycle and the carriage trades have their own particular objects and traditions, which cannot be successfully harmonized with those of the motor vehicle trade. Efforts to accomplish this will only result in friction and loss to all interests concerned.

Is This a Loophole of Escape?

A bill was introduced in the New York State Senate last Friday which seems to have a bearing on the New York Electric Vehicle Transportation and New York Autotruck Cos. It gives to any corporation which owns and has been operating a stage route for a period of five years in any city of the first class the right to extend its existing routes at any time and to operate them by electricity or other motive power approved by the State Railroad Commission.

This looks very much like a change of motive power for the Lead Cab companies, which are just now languishing in the Slough of Despond, owing to the excessive zeal and small discretion with which they were promoted.

A Correction.

At the request of the editor, Hudson Maxim recently sent The Horseless Age some cuttings from English newspapers containing some rather extravagant statements about motor carriages by Hiram S. Maxim and some editorial comments thereon.

In our issue of March 7 reference was made to these press cuttings under the head of "A 'Promised' Revolution in Motor Vehicles, by Another Discredited Expert." By an oversight this matter appeared as a communication from Hudson Maxim, which it was not.

Pennington's flying machine company ought to find its first customers among the Anglo-American promoters, who want to fly from the wrath to come. But whither? There are no more worlds to bunco. Exposed in Britain, on the Continent and in the United States, they stand little chance of success anywhere. Motor stock jobbers have reached the end of their rope.

The National Highway, for which many prominent persons are agitating, will no doubt be a grand good thing some day. What is wanted most now is roads, common, everyday roads, to facilitate the world's work and smooth the way for the motor vehicle. Business before pleasure, the familiar adage says.

Readers of The Horseless Age who have had experience in the use of acetylene gas as motor fuel are requested to communicate with the editor in regard to contributions to our Acetylene Number, to be issued in May.

"The Trail of the Serpent."

No better proof of the damage which unscrupulous promoters have done the motor vehicle industry could be asked than is afforded by our London correspondence this week. Two of the Lawson-Pennington corporations have recently filed their annual reports, showing a most unsatisfactory condition of affairs. Overcapitalization, bad management and the excessive drains of the original promoters have brought them both to the verge of bankruptcy unless the shareholders again put their hands in their pockets and provide the necessary working capital. And this in an industry of almost unparalleled promise, whose product the public are clamoring to buy, and the output in which is quite certain to fall short of the demand for some years to come! Verily, the stock jobber is the bête noir, the wily serpent in this garden of promise, and he should be shunned like a pestilence by all sincere and honest workers in the field.

Two-Cycle vs. Four-Cycle Vehicle Motors.

By Herbert L. Towle.

The two-cycle gasoline engine has for some time been in more or less successful use in launches and for small stationary powers, and the inventor who turns his attention to the motor vehicle field will naturally inquire why it may not be used here also. They have certain advantages, real or seeming, for the former classes of work, and it is not surprising that the commercial success of their builders should stimulate further interest in them.

The two-cycle engine can be built at a materially lower cost than the four-cycle engine. It has fewer parts and the construction of such parts as there are usually requires only the simplest mechanical processes. It has no valves, except it be one in the air supply pipe or at the transfer port. The cylinder and crank case are usually cast in one piece, and the machine work on them is thereby reduced to a minimum. The absence of valves permits a very simple design of cylinder head, with very little machining. The crank shaft brasses are made solid, and may be thrown away when worn at less expense than would be involved in lining up split brasses. There are no cam shaft and gears, and the careful workmanship required on these and on the poppet valves of the four-cycle engine is saved. The pressure on the crank shaft brasses is continuously downward from the piston, unless the latter be made so extravagantly heavy that its inertia exceeds the compression above it, and it is therefore possible to permit considerable wear in the crank shaft brasses before these require attention; the only precaution needed being to keep the stuffing boxes at the ends of the bearings tight.

Moreover, the vibration of the single-cylinder two-cycle boat engine is apt to be, or may be made, notably less than that of the single-cylinder four-cycle engine of the same power. This, of course, is due to the fact that the two-cycle engine delivers a working impulse at every revolution, so that for the same speed the individual impulses need to be only half as powerful as those of the four-cycle engine, and consequently the torque reaction is correspondingly less. For the same reason, for equal speed the fly wheel of the two-cycle engine may be lighter than that of the four-cycle engine.

It may be granted at once that in the matter of the downward pressure on the bearings the two-cycle engine has for vehicle use an advantage over the four-cycle. It is not entirely certain that an engineer would regard this feature as a recommendation in the case of an engine which was under the care of a competent mechanic, but the position of the vehicle motor is likely to be quite otherwise in this regard, and too much cannot be done in the direction of making the motor take care of itself for the longest possible period. This, however, cannot be taken as a sweeping indictment against the four-cycle engine, since the durability of its bearings is more than anything a question of proper design and proper material, and there is no obvious reason why the four-cycle engine should give more trouble in this regard than the double-acting steam engine.

It is probable that the design of the two-cycle engine would be somewhat modified for vehicle use by making its crank case of aluminum or aluminum alloy and bolting it to the cylinder, as is now done with the small four-cycle engines. This would add something to its relative cost, though not enough to be a serious objection in the face of compensating advantages. Although it would cost a little more to manufacture, it would still be no more liable to get out of order, as the working parts would not be increased thereby, and it is after all the liability to get out of order which determines the eventual cost of the engine.

When, however, we come to the matter of torque reaction, and to the question of weight for a given power, we find the conditions materially different in vehicles from what they are with boat engines. The vehicle motor builder has far outstripped his brother of the gasoline launch in the speed at which he runs his engines, and at this point the two-cycle engine is apparently unable to keep the pace. The speed of the four-cycle engine is limited more by conditions of mechanical design than by any difficulty in internal action, and it is only a question of proper lightening of reciprocating parts, proper balancing, proper distribution of metal and sufficient bearing surface and lubrication to increase the speed of the four-cycle engine beyond any limits that can now be set. The difficulty of tardy combustion indeed arises, but with improved vaporizers and scientific regulation of the ignition this does not appear to present insuperable obstacles. In the two-cycle engine, however, instead of having the period of one full stroke each for exhausting the burnt gases and drawing in the fresh charge, both of these operations must be performed in a space of time which rarely exceeds one-eighth of a revolution; and as the time of a revolution is shortened it soon becomes impossible either to get the burnt gases out or to get all of the fresh mixture in. This can be done only by making the exhaust occur abnormally early, or else by putting the fresh charge under too high a pressure before it is admitted into the cylinder. As all the work done in compressing the charge in the base of the engine is wasted by the prompt expansion of that charge into the cylinder, it behooves the designer to keep the loss from this source as low as possible. The transfer passage which conveys the charge should therefore be made as large as possible, and free from sharp turns and similar obstructions. With all that can be done in this direction, however, there is still a strict limit to the speed at

which it is practicable to run these engines, and this speed will obviously be much lower than that of the four-cycle engine. It follows, therefore, that for the same power the cylinder dimensions of the two-cycle engine will by no means be only half those of the four-cycle engine, and its weight will be more than a bagatelle. Even in boat engines it is not uncommon to find that the weight of the two-cycle engine of a given power is equal to that of the four-cycle engine.

This is not due solely to the lower speed. In the very nature of the case, the fresh charge must mingle somewhat with the burnt gases in the cylinder, and it requires special precautions in design to prevent it from escaping in the exhaust. It is, in fact, necessary to throttle or otherwise restrict the volume of the entering charge to less than a cylinderful, and this is, I believe, the invariable practice. This does not necessarily involve a lower thermal efficiency, provided the compression be made somewhat higher to insure prompt combustion, but of course it curtails still further the power that can be developed from a given size of cylinder.

In connection with the matter of speed may be mentioned that of muffling the exhaust. Most mufflers act either by dividing the exhaust into numerous small streams or by baffling or obstructing it, so that on its final issue from the muffler it is moving relatively slowly. These two classes shade into each other by imperceptible gradations, and as a matter of fact there are few, if any, of the former class which discharge the exhaust as freely as it issues from the open pipe. This feature is of no great consequence with the four-cycle engine, because the gases are expelled by the motion of the piston, and the only loss is that due to the back pressure, which, with a properly proportioned muffler, should be small. In the two-cycle engine, however, it is evident not only that there is loss from back pressure, when such presure exists, but that the fresh charge will continue to enter the cylinder only so long as its pressure exceeds that of the burnt gases within, and therefore even a pound of pressure in the exhaust pipe at the end of the transfer period results in a serious diminution in the working capacity of the engine.

The above are what may be termed the negative faults of the two-cycle engine. They are not in themselves faults, but rather handicaps which prevent it from competing on even terms of weight and speed with its rival; and if no more serious blame were atttached to it than these it would find a ready field in moderate-priced vehicles for special classes of work. Unfortunately, its mechanical simplicity is attended with anything but simplicity of action. In the four-cycle engine it is possible to define almost rigidly by mechanical means the conditions under which the internal action takes place. Knowing what influences affect the duration of combustion, such as piston, leakage, faulty ignition, irregular wall temperature and uncertain mixture, we can provide for these in the mechanism of the motor itself; but with the two-cycle engine it is substantially impossible to predict what is taking place at the moment of transfer and just after it. The fresh mixture may or may not reach the igniter. If the engine governs by throttling the motor is likely to skip alternate explosions at half load, and to deliver sharp impulses on alternate revolutions, when the cylinder is filled with rich mixture. At high speeds likewise explosions may be skipped for the same reason, and in this regard the launch motor, which runs at a uniform speed, is at a decided advantage. Again, the mixture in the base may and will leak up around the piston and escape from the exhaust port, unless measures are taken in the form of rings at the bottom of the piston to prevent this. The burning charge will force its way into the transfer passage if it can, and there are several devices on the market for preventing this. One company, which places its exhaust and transfer ports on opposite sides of the piston, interposes a rotary valve plate between the compressed charge in the base and the transfer port. Other concerns carry the transfer passage to the top of the cylinder and deliver the charge through a spring seated poppet valve. It is obvious that with such an arrangement the shape of the valve disk and the tension of the spring will have an important influence on the behavior of the engine; and at least one concern has found it expedient to make the spring quite stiff.

A recent patent proposes to admit a fuller charge by using a mechanically actuated piston valve in the cylinder head; but, as above noted, the restriction of the charge is within due limits a necessary feature, and the use of any sort of a piston valve to confine the burning charge is to be regarded with distrust.

A characteristic trick of the two-cycle engine, which many beginners find very annoying, is the striking back of the flame in the crank case, causing an explosion there, and a prompt stoppage of the engine, if the latter is running under load. This is due to the combustion being prolonged till the fresh charge enters the cylinder, and the proper remedy is to hasten the combustion. Either insufficient compression, poor mixture or late ignitiion may be the cause of this, and the trouble once found is easily cured.

It may be readily apprehended from the foregoing why it is that a given two-cycle engine will often work like a charm in the hands of its owner, or of some other expert individual, while no one else can make it go; and also why there should be such singular differences in different engines from the same makers. Evidently, however, a motor of this description is not one to put into the inexpert hands of the general riding public, and the fact that it can be cheaply produced is insufficient to recommend it.

The writer believes that the two-cycle engine is in a large measure the victim of that class of builders which has taken advantage of the desire for cheapness to produce the lowest priced thing which could be put on the market; and that it could be made in performance as well as in workmanship a much better engine than most of its representative specimens are to-day. At the best, however, it may be doubted if it can ever approach in its action the precision of a good four-cycle engine, and if we may judge from the experience of its inventors up to the present it is not likely to be an easy task to make it perfect.

Wants a Mechanical Horse.

Newton Center, Mass., March 19.

Editor Horseless Age:

I have used a steam carriage and also Dion tricycle in my professional work in Newton, Mass., for nearly a year. My experience leads me to seek for an explosion motor on a plan approaching the Pretot system, mentioned in the Feb. 14 number of The Horseless Age, with an idea of using the fore car to draw my close cab in stormy weather, Stanhope, carryall, buckboard, etc., as desired, by simply attaching the front of the vehicle to it.

Can you direct me to builders of this class of motors; and what can be said of their claim to our favor? Yours,

S. A. SYLVESTER, M.D.

Autocar Co.'s 1900 Model.

The Autocar Co., who are this week moving from Pittsburg, Pa., to their new factory at Ardmore, Pa., have completed their 1900 model. The carriage, herewith illustrated, weighs 635 lbs., with water and gasoline for a 75-mile run, and seats two persons comfortably.

The motor, of the Otto cycle type, has two cylinders, with cranks set at 180 degs., and develops 4⅛-h.p. by actual brake test.

Power is transmitted to the rear axle by means of a countershaft consisting of a speed drum, to which band brakes are applied, so that any speed, including a hill-climbing speed, may be obtained.

The vehicle is entirely automatic, both as to fuel supply and lubrication, and is controlled by a single lever.

The frame is composed of steel tubes, with brazed joints. The front axle is flexible to compensate for the inequalities of the road. Wire wheels, with flared rims and 2½-in. pneumatics, are employed. A condenser cooling the water from the cylinder is placed under the footboard.

The vehicle is handsomely painted and upholstered, and top, storm apron, etc., are supplied at small additional cost.

The carriage is backed by simply reversing the controlling lever.

The factory at Ardmore will be in full operation during the month of April and facilities will be rapidly increased.

An innovation adopted by the Autocar Co. is to take an indicator card from every engine and to give it to the purchaser as a guarantee of the horse-power of his motor.

Motor Vehicle Customs Regulations in Australia.

Phillips, Ormonde & Co., of Melbourne, write good news for exporters of motor vehicles to Australia. The Victorian customs authorities have at last given a decision which is much in their favor. According to the earlier interpretation of the act motor cars were charged at the rate of £40 on the vehicle and 30 per cent. upon the value of the motive power. This was excessive and led to much controversy among those concerned. But now that the importation of motor carriages is becoming more frequent the Department finds it difficult to discriminate between the value of the car and the rest of the vehicle. It has accordingly been decided to classify motor cars under the head of "vehicles not otherwise enumerated," and they will for the futur. be subject to an ad valorem duty of 25 per cent.

Automobile Club Conviviality.

Last week Tuesday evening 50 members of the Automobile Club had a beefsteak supper à la Bohème. Grotesque ornaments suggestive of the automobile decorated the walls and tables. The subjects of discussion were wholly on that order. Albert R. Shattuck, chairman of the good roads committee, told of his committee's work for good roads, and several other members spoke informally. On Monday evening, April 2, a complimentary dinner will be tendered to Gen. Nelson A. Miles at the club rooms in the Waldorf-Astoria.

The Clark Steam Delivery Wagon.

Edward S. Clark, 272 Freeport St., Dorchester, Mass., has just completed a steam delivery wagon for J. G. & B. S. Ferguson, bakers, of Boston, Mass.

The wagon weighs 1,750 lbs. with all supplies on, and has a 63-in. wheel base. The engine is a double-cylinder reversible, giving 8-h.p. at 400 revolutions. The vertical shell boiler contains 650 ½-in. tubes, giving 90 sq. ft. of heating surface. A double burner is employed, a spray burner heating up the main burner in about two minutes. Steam can be made in about seven minutes from the time of striking the match.

The wood wheels, 32 and 36 in., respectively, are shod with 1¾-in. solid tires.

Golden Gate Park Franchise.

Dr. C. D. Salfield, San Francisco, Cal., has applied to the Park Commissioners for an exclusive 25-year franchise to operate motor carriages and omnibuses in Golden Gate Park and connecting boulevards at a stipulated rate of fares. He is willing to assume all responsibility for accident, and in return for the concession agrees to pay 3 per cent. of the gross receipts for the first 5 years, 4 per cent. for the next 10 years and 5 per cent. during the remainder of the life of the franchise. He is willing to guarantee a minimum of $1,000 a year to city.

San Francisco Automobile Club.

The San Francisco Automobile Club is now an accomplished fact. A temporary organization has been effected, consisting of S. D. Rogers, chairman, and B. L. Ryder, secretary. J. M. Wikins and Hiram T. Bradley were appointed a committee to secure suitable quarters. The names already on the list are:

1900 MODEL OF THE AUTOCAR CO.

O. N. Owens, Hiram T. Bradley, James K. Cambridge, C. H. Howard, A. G. Wieland, E. D. Rosenbaum, William Riddell, S. Goodenough T. J. Sparks, J. M. Wilkins, S. D. Rogers, Byron Jackson, Charles E. Moore, Prof. J. B. McChesley, W. L. Elliott, B. L. Ryder, W. R. Woolsey, Herman Oelrichs and T. H. Lawn.

To Build Gasoline Launches.

The American Motor Co. has been absorbed by the Automobile Co. of America, but its charter is being used as the basis of a new organization, which under the same name will confine itself exclusively to the building of boats and fitting them out with gasoline motors, furnished by the Automobile Co. of America. The new company also absorbs the business of the Monitor Vapor Engine & Power Co., of Grand Rapids, Mich., securing the services of Wm. S. McCay, manager of that company, and also of L. S. Gardner, of New Orleans, La., one of the best marine engineers in the country. Large works will be erected on the Hackensack River. By this combination the American Motor Co. will own or control about 40 patents on gasoline engines, propellers, etc.

Patent on Pneumatic Tired Vehicles Declared Invalid.

The patent on pneumatic rubber tires for road vehicles, which was granted in March, 1893, by the Commissioner of Patents, has been declared invalid by the Supreme Court of the United States, and anybody and everybody may use the tires without fear of being required to pay royalties.

The case has been in the courts six years. It was started by the Hickory Wheel Co., which was one of the corporations owned by Col. A. A. Pope. Sterling Elliot, the League bicycle man, declared that the pneumatic tire was his invention, and after his application had been rejected by the patent examiner and the board of appeals in the Patent Office, he finally got his patent from the Commissioner himself and then transferred it to the Hickory Wheel Co. In the meantime, pneumatic tires for racing rigs had attracted attention because of the remarkably fast time made by horses drawing them and practically all the wagon manufacturers who made such rigs and the lighter wagons on which such tires could be used had begun to manufacture them.

After the patent was granted the Hickory Wheel Co. sent out a legal notice warning all the wagon makers that they were infringers and warning all wagon users not to use pneumatic tired vehicles unless they were equipped with the Hickory wheel. At the same time agents were sent around to the manufacturers proposing an agreement that established a royalty of $50 on every sulky or other pneumatic tired vehicle made. These agents said that the money would not be paid by the manufacturers but by the purchasers of the vehicles. The proposition was made among others to W. S. Frazier & Co., carriage manufacturers, of Aurora. They decided to fight the patent. They refused the proposition and went ahead making pneumatic tired sulkies. The Hickory Wheel Co. instantly instituted proceedings for an injunction and for damages, and it is this suit that has just been finally determined. The case was originally before United States Circuit Judge Grosscup in Chicago. He decided in 1898 that the patent was invalid for want of novelty, and the decision of the Supreme Court sustains him.

While all the manufacturers of wagons and sulkies were interested in the case, Frazier & Co. fought it alone, a scheme for a pool to help to defray the expenses falling through. While the case was before the courts evidence was taken in many States. It came out that the first pneumatic sulky seen in the United States was brought here by M. P. Ketcham, a Canadian banker, in 1891. Mr. Ketcham had a dog named Doc, and the sulky was hitched to this dog, which gave trotting exhibitions. The sulky was practically a model of the pneumatic tired sulkies made later, and alleged to infringe the patent of the Hickory Wheel Co. This original pneumatic tired sulky was introduced in evidence. Among the witnesses who testified in the case were Robert Bonner, J. Malcolm Forbes, J. H. Steiner and C. S. Caffrey.

The Supreme Court, in deciding the case, said: "It is a bald aggregation of parts, old in the art, each part operating in the old and usual way, without any semblance of invention in the mechanical means by which a new or useful result is brought about, and even if the combination were otherwise patentable, the previous state of the art shows it was not new to this patent. Pneumatic tires had been used and fully developed before in connection with bicycles, as early as 1891. Solid rubber and cushioned tires had been used long before and were familiar to the public. These and the pneumatic tire, which now takes their place, had also been used upon small wheels of all sizes, such as are called for by this patent."

The court called attention to the fact that the advantage of pneumatic tires had been pointed out by Thompson, an English inventor, as long ago as 1845.

LONDON NOTES.

London, March. 5.

THE AUTOMOBILE CLUB.

The annual meeting of the Automobile Club of Great Britain was held on Monday last. The report for 1899, presented to the meeting, showed a membership of 586, being an increase during the year of 206. The guarantee fund now amounts to £1,521. After referring to the Richmond Show, the general work of the club was referred to, including the formation of a standing committee to deal with matters of urgency, publication of club notes and notices, and the formation of branches at Manchester and Leicester, and in Scotland and Yorkshire. Correspondence with the Local Government Board, the organization of a Motor Vehicle Users' Defense Association, the compilation of racing rules, the series of house dinners, lectures, tours, runs and meets, etc., were all recalled, and the report closed with a programme for 1900 embracing the following points:

1. The lodging of petitions in Parliament against bills which might vexatiously restrict the use of motor vehicles. 2. Correspondence with the Local Government Board as to recommendations made by county and rural councils in respect of motor vehicles. 3. The 1,000-mile trial and exhibitions. 4. Four trials of 100 miles. 5. Three days' trials of electrical vehicles. 6. Trials of the horse-power of motors and horse-power on road wheels of motor vehicles. 7. Whitsuntide tour, an autumn tour, meets, and runs. 8. Meets at Hurlingham, Ranelagh and Sheen House Clubs, specially for the training of nervous horses to encounter automobiles without fear. 9. Race meetings for motor tricycles on the track. 10. A tour to Paris and big race for British automobiles. 11. The appointment of hotels at which special provision is made for automobiles. 12. House dinners, lectures, papers and discussions. 13. Special meet of motor vehicles and annual dinner on Nov. 14.

THE FORTHCOMING MOTOR EXHIBITION.

I have already mentioned that a motor exhibition is to be held at the Agricultural Exhibition, Islington, from April 14 to 21 next, under the control of the Automobile Club and the direction of Cordingley & Co. This is an amalgamation of the two exhibitions which were held in June and July of last year, and promises to be one of the most important so far held on British soil. Already over 80 different firms have taken space, including two American firms—the Locomobile Co. and the Riker Co., the latter represented by Messrs. Shippey.

RACING SPEED IN FRANCE.

That the pace in French races this year is likely to be a "hot" one may be gauged from the result of the "Circuit du Sud-Onest" race, which was run off in the Pau district last Sunday. The winner was the well-known M. René de Knyff, who covered the distance of 335 kilometers in the extremely low time of 4 hours 46 minutes 57 seconds on very heavy roads, or an average speed over the whole course of 43¾ miles an hour. M. Charron, the well-known chauffeur, is reported to have placed an order for a special racing carriage for the forthcoming Gordon Bennett International Cup race. It is said that the price for the carriage has been fixed at $7,000, and that the builders, whose names have not transpired, are under bond to pay an indemnity of $2,000 if the vehicle is not completed in time for the race.

TESTS OF AIR-COOLED GASOLINE MOTORS.

Mr. Chas. Sangster, of the Cycle Components Co., Birmingham, recently made some tests with air-cooled motors, which prove how unsuitable these engines are for light voiturettes, fitted with variable speed gear, however well adapted they may be for tricycles. The tests were made in a shop with an ordinary temperature. A slight blast from a pipe was allowed to play on the radiating fins of the cylinder, although it is admitted that this artificial cooling would not be equal to that of rapid movement through the outside air at high speed. The following are the particulars of the tests:

Ten minutes' run, tests taken at first, fifth and tenth minutes; speed of motor between tests, 1,700 to 1,800 revolutions. No load between tests:

	Revolutions.	Weight in pan.	Bal.	B.H.P.
First minute	2,090	12 lbs.	.5 lbs.	2.33
Fifth minute	1,900	12 lbs.	.5 lbs.	2.11
Tenth minute	1,765	12 lbs.	.25 lbs.	2.01

Ten minutes' run, tests taken at first, fifth and tenth minutes; 11½ lbs. in pan carried through whole run:

	Revolutions.	Weight in pan.	Bal.	B.H.P.
First minute	2,095	11½ lbs.	.25	2.28
Fifth minute	1,780	11½ lbs.	.75	1.85
Tenth minute	1,710	11½ lbs.	1.5	1.65

MOTOR CARS IN IRELAND.

Ireland is intensely conservative on the motor question. A proposal lately mooted at Waterford to start a public service of motor cars in the town has aroused the local car owners and jarveys, who have decided to resist this motor car epidemic to the utmost and have called upon the corporation not to grant the necessary licenses, which would be detrimental to the interests of car owners, car drivers, smiths, farriers, saddlers, shop keepers, etc.

LAWSON REORGANIZATION REORGANIZED.

The Motor Manufacturing Co., Ltd., of Coventry, which itself is a reconstruction of the Great Horseless Carriage Co., Ltd., one of the Lawsonian productions, is to be again reorganized. In a recent letter I referred to the balance sheet lately issued by the concern, showing a loss of £18,161. The company has a capital of £300,000. The new concern it is proposed to form will have a similar capital, and present shareholders will be allotted a number of shares equal to their present holding, but with this difference, that instead of being fully paid-up £1 shares, as at present, they will only be credited with 17 shillings per share, leaving a liability of 3 shillings per share to be paid, 3d. per share on application, 9d. on allotment and the remainder when required, but no call to exceed 1 shilling per share, or to be called up at intervals of less than three months. This, it is calculated, will provide an additional £45,000 working capital. The proposal is to be submitted to the shareholders at a meeting on the 13th inst. The company has undoubtedly an excellent plant, has plenty of orders on hand, and is turning out practical carriages, and it would be a pity to see it go under for want of funds. That this will be the case I do not for a moment anticipate, but the fact that a company originally promoted by the Lawson group has to be reconstructed twice during a period of less than five years is not one which tends to inspire confidence in the investing public.

THE 1,000-MILE TRIAL.

In automobile circles here the forthcoming 1,000-mile trial of the Automobile Club is now the all-absorbing topic.

Entries continue to be received at a good rate, and ere the list closes it is more than probable that fully 100 vehicles will be enrolled. So far 75 different carriages, ranging from the two-seated voiturette up to the heavy public service wagon, have been enrolled, and the trial is being looked forward to as likely to result in a tremendous impetus to the horseless vehicle movement in the United Kingdom.

ANOTHER RECONSTRUCTION.

Another company which has found it necessary to call a meeting of shareholders to consider a reconstruction scheme is the London Motor Van & Waggon Co., Ltd., which, with a paid-up capital of £161,984, made a profit last year of £393. This is another of the concerns formed three or four years ago by the Lawsonian group, the British Motor Syndicate holding 10,000 shares, equal to £50,000, in return for a license. The reconstruction proposal, which is to be considered on the 12th inst., provides that the holder of every present fully paid £5 share shall be allotted four new 10-shilling shares, with only 7 shillings paid and 3 shillings liability per share. How the shareholders will receive this remains to be seen, seeing that for every £5 they only receive 28 shillings, plus a liability of 12 shillings.

THE ESTCOURT MOTOR STARTER AND WATER COOLER.

In your issue of Feb. 21 Mr. Howard, of Buffalo, refers to the Estcourt motor starting device, recently described and illustrated by a diagram. Mr. Howard says "either the writer does not understand this thoroughly, or it is his opinion the device has never been used." Mr. Howard may put it down as the former, for the other day I saw Mr. Estcourt, who is one of our ardent chauffeurs here in London, start his motor quite easily from the seat. Indeed he now prefers to start his engine from the seat, rather than use the detachable starting handle. I am able to send you an illustration of the device as fitted to Mr. Estcourt's Daimler carriage, which shows the device quite clearly. If Mr. Howard will read the description again he will see that it is not the driver's pull on the chain which causes the motor shaft to be rotated. The chain is pulled up its full distance, this uncoiling the spring inside the drum on which the chain is coiled. This done, the driver suddenly lets go and it is the tendency of the spring, when the pull is taken off, to assume its normal position that causes the rotation of the ratchet wheel on the motor shaft, the chain being clear of this wheel when the spring has assumed its normal position. The illustration also shows the arrangement of water cooling pipes Mr. Estcourt has fitted to his carriage as a substitute for the pump, which he has always found troublesome. Altogether 80 ft. of Clarkson's special radiating tube is employed, the two large pipes across the top of the front of the carriage also forming part of the circuit. The connection between the water jacket of the motor and the cooling device is by means of the three pipes seen at the left and one at the right.

The Kuhlstein Gasoline Carriage.

The Kuhlstein Wagenbau Anstalt, of Charlottenburg, Berlin, have lately built a new type of gasoline carriage for two. The motor, located at the rear, is of the horizontal two-cylinder type, of 5-h.p., with water jacket and electric ignition. Three speeds forward—8, 18 and 27 kilometers an hour—and a reverse motion are provided. The motor drives a countershaft by belting. The countershaft is connected by a variable gear, consisting of a train of spur wheels, to an intermediary shaft, and from the latter to the rear axle by the usual sprockets and chains. The carbureter, which is of a special type, is gravity fed. The motor and mechanism is all mounted on a channel steel frame, spring suspended on the axles. The wheels are of wood, with solid rubber tires. Steering is controlled by a long lever, the variable gear being manœuvred by a vertical lever at the side of the steering standard. The body can be quickly detached from the frame. The weight of the carriage complete is about 1,500 lbs.

The postal authorities at Birkenhead are reported to be about to inaugurate some trials with motor mail vans.

The latest concern in Italy is the Societá Milanese d'Automobili, Isotta, Fraschini & Co., which has just been formed in Milan with a capital stock of $100,000, to manufacture, repair and sell automobiles.

The introduction of electric cabs in the towns of Wurzburg and Nurembourg is contemplated. In the former town, where the speed is not to exceed 9 miles an hour, a Munich firm has the matter in hand, while in the latter a Cologne concern proposes to run a number of Lohner carriages.

THE ESTCOURT MOTOR STARTER AND COOLER.

MINOR MENTION.

The Union Automobile Co., of Maryland, has been incorporated.

Ground is being broken for a new motor vehicle factory at New Orleans, La.

The United States Projectile Co., Brooklyn, N. Y., are manufacturing vehicle motors.

Frank Snell, Waterville, N. Y., is putting the finishing touches on a gasoline carriage.

The Boston Woods Motor Vehicle Co. has been incorporated, with $300,000 capital. Samuel L. Powers is president.

The Kensington Bicycle Co., Buffalo, N. Y., are building an addition to their plant for the manufacture of automobiles.

Twenty-two licenses have been granted to drivers of motor vehicles in Chicago. It is said there are 53 yet to be examined.

Hiram T. Bradley, an engineer of Oakland, Cal., is organizing a company there to manufacture gasoline vehicles of his invention.

The large electric vehicle or break mentioned in our London correspondence of March 7 was built by J. M. Quinby & Co., Newark, N. J.

The Lunkenheimer Co., Cincinnati, O., have recently added to their stock of valves an Angle Generator Valve for feeding gasoline to gas engines.

The Conrad Motor Carriage Co. has been organized at Buffalo, N. Y., with $25,000 capital, by Julius Potter, Frank P. Conrad and David W. Adams.

The Golden Gate Park Commissioners, San Francisco, have barred gasoline vehicles from their domain, admitting electric and compressed air carriages, however.

The Emerson-Fisher Co., carriage builders, Cincinnati, O., who are preparing to put out steam vehicles, have opened the license question, which the local authorities had not yet considered.

It is reported that the Winslow Automobile Co. has purchased the H. D. Ruas Agricultural Works, Doylestown, Pa. F. M. Conley, of Philadelphia, is the chief promoter of the deal.

Halcolm Ellis, mechanical engineer, 417 Pine St., St. Louis, Mo., has built a single-cylinder vehicle motor, 5 x 5 in., and would like to negotiate with parties for its manufacture and sale.

C. O. Heggem, superintendent of Russell & Co.'s agricultural works, Massillon, O., whose patent was described in last week's issue, is said to be preparing to manufacture his vehicle in that town.

The Woods Electric Vehicle Co is a new Wisconsin corporation, with $100,000 capital, organized by F. L. Pierce, Frank R. Bacon and Rollin B. Mallory to operate electric vehicles in Milwaukee.

We have had a number of inquiries for castings of the 1-h.p. explosive motor described in our Explosive Motor Number. The Lowell Model Co., Lowell, Mass., are prepared to furnish them.

The Foster Automobile Co., Rochester, N. Y., has been organized with $100,000 capital to manufacture steam and electric carriages. The directors are G. G. Foster, Thomas H. Yawger and Clinton D. Martin, all of Rochester.

The Friedman Automobile Co., recently organized at Chicago, Ill., with $100,000 capital stock, announces its intention to build airships as a side line. O. J. Friedman, James Rosenthal and Walter W. Robinson are the incorporators.

The gasoline stage made by the Best Mfg. Co., San Leandro, Cal., for the Kern Automobile Transportation Co. is reported to have made the trip from Oakland to San Francisco, a distance of 50 miles, in 2 hours 17 minutes on 30 cents' worth of gasoline.

Oscar S. Lear, a Columbus, O., bicycle dealer, has constructed a motor bicycle weighing about 75 lbs. and having as auxiliary power a small two-cycle gasoline engine located at the bottom bracket and provided with two small fly wheels. He intends to manufacture it.

It is reported that E. B. Byington, H. M. Posten and Charles F. Walter, of the Lehigh Valley Automobile Co., have ordered from the Cortland Carriage & Cab Co. 68 omnibuses, to be put in service at Atlantic City, N. J., and along the line of the Lehigh Valley R. R. in Pennsylvania. Storage batteries of the Electric Development Co., of Philadelphia, are mentioned as the source of power.

The Denison Electrical Engineering Co., New Haven, Conn., are building an omnibus for Geo. D. Jones, a liveryman of Torrington, Conn., to carry nine passengers and baggage. The motor is a 12-h.p. Yale two-cycle gasoline engine, and the vehicle complete will weigh over 2,000 lbs. Four-inch steel tires will be used and grades of 16 per cent. will be surmounted.

The Duryea Power Co. has just been incorporated under Pennsylvania laws to build motor veicles at Reading Pa., under the supervision of Charles E. Duryea, in other designs than those turned out by the Peoria company. Among the vehicles manufactured will be hansom cabs for city use. The capital stock is $100,000, and the incorporators are prominent capitalists and manufacturers of Reading.

The Smith Motor Co., who have been conducting experiments in gasoline vehicle motors for some time in Newark, N. J., are now building a 3-h.p. motor for a racing machine to be ridden by a well-known bicycle crack, who expects to attain a speed of 50 miles an hour with it. Several features of this motor have been patented, namely the carbureter, the ignition device and the muffler. Full details will be given in a later issue.

Patents on a pneumatic tire which the inventor believes avoid infringement on the famous Tillinghast single-tube patents have been granted to F. A. Seiberling, secretary of the Goodyear Tire & Rubber Co., Akron, O. The tire is made by one process of vulcanization and is so constructed that when worn out the cover can be replaced by a new one. It is claimed to have all the advantages of the double-tube tire, with the economy in manufacture of the single-tube tire.

The Weston-Mott Co., well-known motor wire wheel and accessories makers, Utica, N. Y., has been reorganized in order to cope with its growing business. W. G. Doolittle has taken the treasurership and Charles S. Mott, M.E., the superintendency of the factory. F. G. Mott retains the presidency. Another building as large as the one at present used will be erected, and with new capital and increased facilities the business will be vigorously pushed along all the lines.

METROPOLITAN ITEMS.

The Automobile Club of America has selected the week from Nov. 3 to 10 for the trade show which it proposes to hold at the Madison Square Garden, New York.

The Consolidated Rubber Tire Co., 40 Wall St., have issued a diagram showing the fluctuations in the price of crude rubber during the past seven years. It is compiled from the India Rubber World.

The Auto Dynamic Co. have leased the premises at 140 West Thirty-ninth St. and opened an electric vehicle emporium under the management of A. L. Stevens, formerly connected with the Electric Vehicle Co.

The Locomobile Co. of America will have two exhibits at the Paris Exposition this summer, one in the Champ de Mars and the other in the Automobile Building in Vincennes Park, where the motor vehicle show will be held.

Feodor C. Hirsch, formerly of the Hirsch Motor Co., is now inventor and mechanical superintendent for the N. Y. Kerosene Oil Engine Co., 31 Burling Slip, who are building kerosene engines from 2 to 10 h.p. for marine purposes.

Albert C. Bostwick, Alexander Fischer and A. E. Schwartzkopf, of the Automobile Club, were the only ones who attempted the run to Ardsley on Saturday. Mr. Bostwick took his Winton, Mr. Fischer, one of the Automobile Co. of America's latest carriages, and Mr. Schwartzkopf a Locomobile.

The Galvanic Metal Paper Co., 61 South Washington Square, manufacture a metal packing which they claim is superior for piston and throttle rods, valve stems, flanges, etc., of both steam and oil engines. Superheated steam pressures up to 750 deg. F. are said to be successfully resisted by it.

James Joyce, Jr., manager of the New York Electric Vehicle Transportation Co.'s Fifth Ave. store, has arranged for lectures to be delivered on Thursday evening, March 22, at the Knickerbocker Athletic Club by Harold H. Eames and Hiram Percy Maxim, engineers of the Lead Cab companies.

The Arthur Co., 188-190 Front St., are issuing a series of leaflets, each specially devoted to a particular kind of gear. They will shortly publish a circular devoted to herring bone or double helical gears, which they recommend for motor vehicles for reasons previously stated in The Horseless Age.

The elegant "Sperry" electric carriages, one of which recently climbed the Fort Lee Hill, a sort of pons asinorum to motorists, are on exhibition at the Manhattan Storage Co.'s motor vehicle station, 213 West Thirty-second St. These carriages are made by the Cleveland Machine Screw Co., Cleveland, O.

COMMUNICATIONS.

Always Use the Wire Gauze.

New York, March 18.

Editor Horseless Age:

I notice in your issue of the 14th inst. a letter by S. asking the cause of the explosion of his carbureter. He does not show in his sketch the usual wire gauze for preventing fire following up the inlet pipe in case of the valve not closing properly. He says the engine ran slowly just previous to the explosion. This would indicate that it was the probable cause, for if the valve did not close tight the compression would be lost and cause loss of power; and with the valve partly open it would only be natural for the flame to get behind it into the pipe, which contains a mixture of gas and air, and follow to the carbureter. All trace of the valve trouble might disappear with the explosion, for if due to any foreign substance getting under the seat it would be likely to be blown out. The wire gauze should never be left out. It should consist of about six layers of fine mesh copper.

HARRY E. DEY.

To Repair a Broken Shaft.

New York, March 12, 1900.

Editor Horseless Age:

One way of repairing a broken crank shaft:

The crank of the motor having been twisted and cracked at the point a, shown in Fig. 1, through the breaking of a connecting rod, the question was how to repair the same. After some thought the way shown in Fig. 2 was adopted.

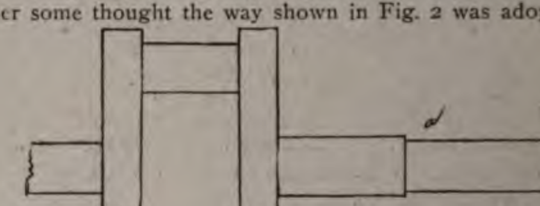


Fig. 1.

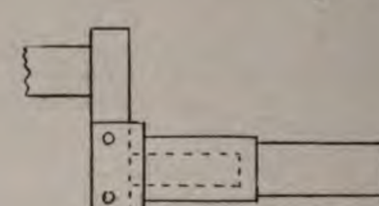


Fig. 2.

The bearing of the crank being 1⅛ in., it was turned down to ¾ in., as shown by the dotted lines. A piece with a square end was forged, this end slotted to fit over the crank and bored to fit over the turned down end. After being forced on two holes were drilled and pins driven in. As the new piece was made 1⅜ in., the bearing was enlarged accordingly, as well as the hole in the fly wheel. The repaired crank shaft is now actually stronger than when new.

H. W. S.

That Carbureter Explosion.

Philadelphia, March 17.

Referring to S.'s inquiry from Brooklyn, dated March 6, as to what caused the explosion in his carbureter, I think it was due to the inlet valve not seating properly, which allowed the flame to reach back into the carbureter. This could be prevented by using wire gauze in the pipe connecting the carbureter with the cylinder.

W. C.

OUR FOREIGN EXCHANGES.

Two New French Voiturettes.

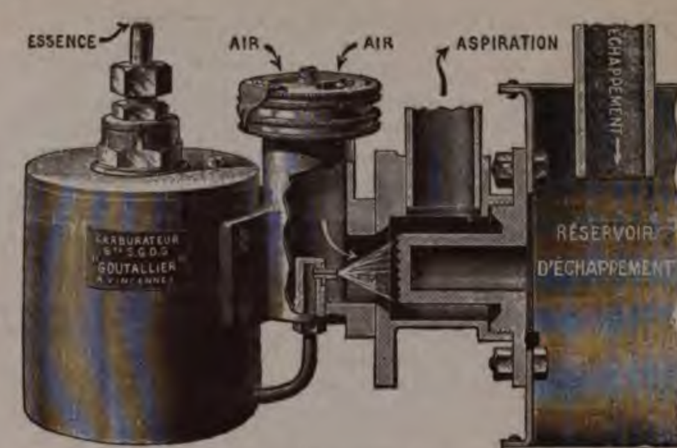
J. B. Clement & Co., of the Palais des Chauffeurs, 120 Boulevard de Courcelles, Paris, have put out the "Eole" gasoline two-seated voiturette. The frame is of tubular construction, while the body is spring suspended. Steering is controlled by a sloping hand wheel, while the wheels are of the suspension type, shod with pneumatics. Power is supplied by a 2¼-h.p. Aster motor located in front, where its air-cooled cylinder receives a full blast of air. The power of the engine is transmitted by a chain to an intermediary shaft, and from the latter to the rear differential axle by another chain centrally located. The second-motion sprocket on the intermediary shaft is provided with a clutch arrangement so that the motor can be cut out from the transmission gear at starting or in blocks in traffic on the road. The carriage weighs about 400 lbs. The firm are also building a similar carriage fitted with two Aster motors, giving nominally 4½-h.p.

THE CLEMENT GASOLINE CARRIAGE.

Messrs. Clement, of Levallois, Paris, are now manufacturing a two-seated voiturette of the type illustrated herewith. The motor is of the De Dion 2¼-h.p. air-cooled type, geared direct to the rear axle by a two-speed gear. The motor is placed well below the body and the sides of the latter are of perforated material, to permit free access of air to the cylinder. Steering is controlled by a sloping hand wheel in proximity to which all the control levers are located. The carriage is capable of attaining a maximum speed of 20 miles an hour. It is this type of vehicle—the two-seated voiturette—which is doing much to popularize the automobile in France, their relatively low price—the Clement vehicle above described being priced at $600—bringing them within the reach of a large number of people.

The Goutallier Carbureter.

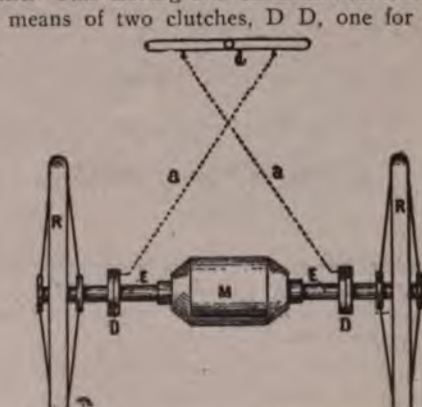
The accompanying illustration of a new carbureter for gasoline motors, which has lately been put on the market by M. Goutallier, of Vincennes, France, is so clear as to need but very brief description. The carbureter is attached to one side of the exhaust muffle, the latter having fixed to it a hollow



piece projecting into the carbureting device. A constant-level gasoline tank is provided at the extreme left, from which a charge of gasoline is drawn by the suction stroke of the motor. The air inlet is seen at the right of this tank. The gasoline emerges from a small nozzle and is sprayed on to the end of the above mentioned hollow projection, the outer end of which is in the form of a grid. Here the gasoline is vaporized and becomes mixed with the air, the explosive mixture passing to the combustion chamber along a pipe in which one or more wire gauze disks to further mix the vapor and air are introduced. The air inlet is provided with a movable cap to regulate the quantity of air allowed to pass. It is claimed for the new device that the arrangement adopted does away with the usual branch pipe through the carbureter from the exhaust, so facilitating the dismounting of the carbureter when necessary, an operation which can be performed by the removal of three nuts.

Getting Rid of the Differential.

Whatever the motive power employed, the differential is a great problem to the designer. Apart from the friction loss of 20 to 25 per cent., there is a rapid wear of all its parts. In order to avoid its use some builders employ two motors, one for each driving wheel, but the Societe Francaise d'Automobiles Electricque, says La France Automobile, has undertaken to solve the problem without employing two motors. The motor shown at M is connected directly or not, as the case may be, with the driving axle. This driving axle turns and revolves the wheels R R by means of two clutches, D D, one for each wheel.



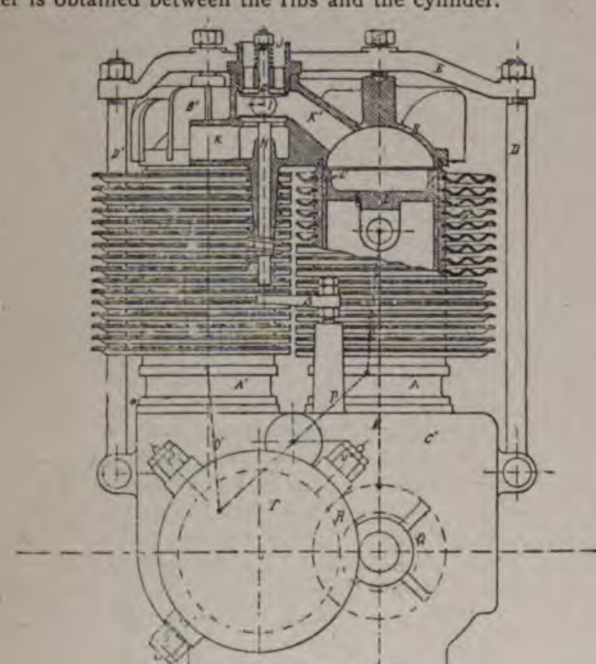
These clutches give both forward and reverse, and are controlled by two rods or chains, a a, attached to the steering standard d.

If we suppose the vehicle in motion and everything in normal position, and the vehicle makes a deviation to the left; then the driver turns his steering rod to the left, whereupon the rod or chain releases the clutch on the left wheel and it runs idle, and the motor acts only on the right wheel, restoring the straight course. If the reverse is done the vehicle deviates to the right.

When the angular deviation of the deflection does not exceed 10 degs., it is not necessary to use the clutches.

The Bourdiaux Jacketless Motor.

An interesting jacketless motor, the Bourdiaux, is shown in a recent number of La Locomotion Automobile. It operates on the Otto cycle and has two cylinders in one case. On the outside of each cylinder is a deep helical groove in which are screwed washers, F F′, of copper or aluminum, the inside diameter of which corresponds with the diameter of the groove in the cylinder. A radial notch is made at a point in the inner edge of each washer so that by spreading the sides of this notch to a height equal to the depth of the helix one is able to screw the washer in place. In order to allow for the difference in expansion of the various metals employed the washers are given a certain tension, both on the outside of the cylinder and in the helical groove. In this manner the close contact necessary for the proper cooling of the cylinder is obtained between the ribs and the cylinder.



BOURDIAUX MOTOR.

The motor has two pistons, but only one crank shaft. In the right-hand cylinder A (see Fig.) the piston L, by the connecting rod M, acts directly on the shaft, while the piston of the cylinder A′ transmits its energy to the same rod M by a gearing composed of the two rods O and O′, connected by the compensating balance P. Vibration is said to be materially reduced in this manner, the moving mechanism is simplified and the cooling of the two cylinders is claimed to be easier than if one cylinder of the same power were used. With a cylinder diameter of 2⅜ in. and a stroke of 2¾ in. and a weight of 25 lbs., the inventor claims to obtain 3-h.p. at 2,000 revolutions. The movable caps B B′ are provided with cast radiating ribs held in place by the standards D D′ and the cross piece E, secured by the screw nut E′. G is the admission valve of the cylinder A, and H is the exhaust valve, mechanically operated by a tappet, S, and a cam shaft driven by gears R and Q. The valves G and H, the passage K′ for the admission and exhaust of the gas, and the exhaust port K are of ample dimensions and have no obstructions.

Ignition is electric, the device being located at I between the two valves G and H. The spark is produced by contact between the terminals V V′ V″ of the distributing box T. By making this box turn on its center the position of the three contact points can be changed at will and the point of ignition thus regulated.

There is a regulator acting upon the tappet S, raising the exhaust valve H, which reduces the speed of the motor through the valve H. The valve remains closed and the motor slows down. This affects both cylinders if necessary.

Phosphorizing Metals.

A member of the old-established firm of E. A. Williams & Son, brass founders, of Jersey City, N. J., recently said to a representative of The Horseless Age:

"Few founders understand the art of thoroughly phosphorizing metals. When they are improperly phosphorized the phosphorus acts more as a detriment than a benefit, on account of the difference in expansion of ordinary metals and phosphor bronze.

"It has been a custom and practice among the smaller founders either to substitute a hard composition for phosphor bronze or to attempt to manufacture and furnish the real article themselves, and make an utter failure of it. Many of them actually believe that the phosphorus enters into combination with the metal, when, as a matter of fact, it is only held in suspension, the same as lead in any copper and tin combination. Lead added to a tin and copper mixture does not mix, but is held in suspension, and when the melting point is raised to a point above that of lead the latter metal will ooze out through the pores. When phosphorus is once held in suspension it is next to an impossibility to remove it, and it can only be done chemically."

Auto Safety Oilers.

As manufacturers who desire to keep abreast of the times the U. T. Hungerford Brass & Copper Co., 121 Worth St., N. Y., have not been unmindful of the possibilities of the motor vehicle. They have designed for this trade a special oiler called the Auto Safety Oiler, which takes up little space, will not leak and has a spout long enough to reach any part of the machinery.

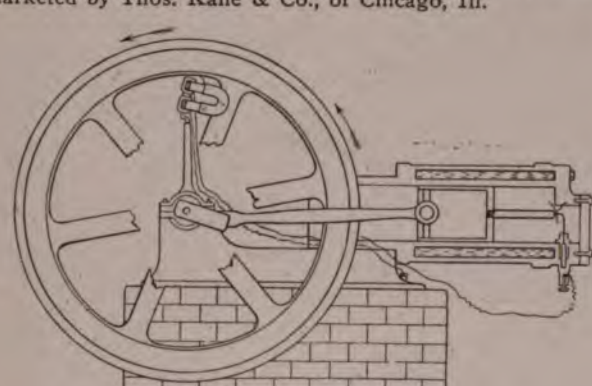
The spout is so arranged as to be easily drawn out of the oil well, extending 3½ in. beyond it, reaching any part of the machine without difficulty. To close the oiler the spout is pushed back over a rod attached to the spout, and acting as a valve prevents the escape of oil. As a further precaution

against leakage, the screw head is packed solid with leather washers, making it absolutely impossible for the oil to pass through.

They are the sole manufacturers of this oiler under patents granted by the different governments, and intend making them in various patterns, both in brass and tin, plain and nickel plated.

The McInnerney Sparking Dynamo.

The great activity in the field of gas and gasoline engine improvement is nowhere better demonstrated than in the interest manifested by electrical inventors in the ignition problem. It has been said that a gas engine is a spark with an engine built around it, and it is now generally admitted that the ignition problem outweighs all others connected with the perfection of gasoline vehicle motors. Batteries and dynamos for this special work are now beginning to appear by the score, inventors seeking to overcome the objections that have been met with in applying both of these devices to this service. Many of the dynamos tested have proved troublesome by reason of the burning out of the armatures, the wearing of the brushes and the difficulty of timing the spark so as to get the best results. One of the most recent of inventions which aim to overcome these difficulties is the dynamo invented by Benjamin McInnerney and now being marketed by Thos. Kane & Co., of Chicago, Ill.



It consists of two parts, a permanent magnet and a keeper. The permanent magnet is preferably bolted to a part of the frame and the keeper is attached to the fly wheel, and in the natural revolution of the engine it passes within 1-16 in. of the magnet in such a relative position that a spark is given inside of the engine to ignite the gas. The permanent magnet consists of a series of laminated plates and in contact with each end is a pole piece consisting of a series of laminae, which are bent to a U shape, one limb in contact with the end of the permanent magnet and the other limb projecting at right angles to the plane of the permanent magnet and having wound around it a coil of wire which connects with the coil upon the other pole piece and is in circuit with the sparking device.

The keeper consists of a series of laminae bolted to the fly wheel at any suitable point. In the operation of the engine the keeper first travels from the toe of the permanent magnet toward the pole end. In consequence of this arrangement there is practically a short circuit of the permanent magnet through the keeper as the latter travels over the magnet, which tends to remove the flux from the pole pieces.

MC INNERNEY SPARKING DYNAMO.

This lowers the flux in the pole pieces to the lowest practical extent just prior to increasing it to a maximum, so that the rate of increase is very rapid, and as the generation of the current depends on the rapidity and magnitude of the change, currents of much greater energy are secured. As the change takes place during the passage of the keeper across the gap between the pole pieces and the ends of the permanent magnet, the time during which the change is developed can be varied by varying the extent of the gap so as to adapt the generator to engines in which there are variations in the timing of the sparking device.

It will be seen by this description that the McInnerney generator has no moving or wearing parts. The passing of the keeper over the magnets strengthens them to their maximum point and there is claimed to be no deterioration in use. The keeper is attached on the fly wheel in such a relative position as to give the spark at the proper time inside of the cylinder. If the engine is constructed with two or more cylinders, an equal number of keepers are required. While there is no change in the construction of the permanent magnet, the generator is so constructed that the coils are water proof and the spark is not affected by oil or water.

The current given by the generator is said to be sufficient to give a spark to start the engine without the use of the battery at slow speed, and as the engine increases in velocity a larger spark is generated, so that it can be used on high speed engines without any deterioration in its life.

Thos. Kane & Co. state that this generator has been successfully used for two years on the Otto and similar types of engines for stationary purposes and on marine and motor vehicle engines of two and four cycle type, and that it has been put under the most severe tests, submerged in water and oil, and running under load hour after hour without missing a spark. It is fully covered by patents in the United States and England, as well as in foreign countries.

The Automobile Club of Great Britain has passed a new rule in regard to reckless driving. Any member guilty of such conduct may be called before the committee and cautioned, suspended or required to resign, according to the gravity of the offense.

MOTOR VEHICLE PATENTS

of the world

UNITED STATES PATENTS.

No. 644,951—Internal Combustion Engine.—John E. Thornton, of Altringham, and James P. Lea, of Manchester, England. Application filed Aug. 1, 1898.

The invention relates to heavy oil engines. Fig. 1 is a sectional elevation; Fig. 2, a sectional plan on line x x, Fig. 1; Fig. 3, a side elevation; Fig. 4, an end view of eccentric g and pawl R for actuating same.

The casing or casting A comprises a cylinder, B, in which the piston D works; a closed or air-tight chamber, C, in which the crank E rotates; a second or auxiliary cylinder, F, with a piston, G, and a combustion chamber, H, with a vaporizer or charge heater of special type.

The main or working cylinder B is separated or divided from the air chamber C by the piston D and is connected thereto by the ports c, through which air compressed in the chamber C can at a certain position in the stroke of the piston D pass into the cylinder B.

At the side of the main cylinder B is placed a secondary or auxiliary cylinder, F, which communicates with the main cylinder B and the air chamber C by the ports c and c′. It

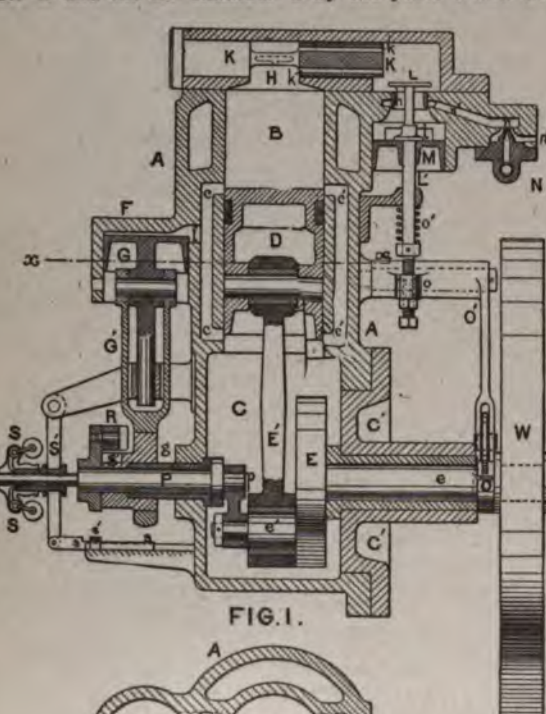


FIG. 1.

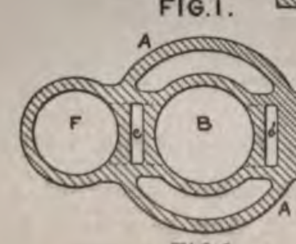


FIG 2.

is also in connection with the outer atmosphere by the port f. The piston G is moved to and fro in the cylinder F by an eccentric g and connecting rod G′.

The main cylinder at the end remote from the crank is connected with or opens into a combustion or ignition chamber H, at the other end of which is a port, h, closed by a valve, L, of the usual disk type, on the end of a reciprocating valve rod L′, by which it is opened and closed.

In the combustion or explosion chamber H is placed a charge heater, K, consisting, essentially, of a block or piece of metal with a number of passages, k, which present a large surface to such gases as pass through it in either direction. The capacity of these passages is small compared to the contents of the main cylinder. The charge heater K is so constructed and arranged or placed that it absorbs heat from the intensely hot gases which are in it during the working stroke of the main piston, and thus it may assume a temperature considerably higher than that of its working charge when fully expanded. The expanded charge, as it leaves the cylinder, passes through the charge heater and carries off any excess of heat. Thus in ordinary work the charge heater cannot fall in temperature lower than that of the fully expanded charge at its moment of exhaust and cannot rise very much above it. The charge heater is thus maintained at a practically uniform temperature. Finely divided oil mixed with a small amount of air is drawn through the charge heater and heated thereby to vaporize the oil. The heat thus abstracted is more than replaced during the subsequent explosion or working stroke.

The spindle or rod L′ of the exhaust valve L is fitted with a piston valve, M, which opens and closes the exhaust port l, so that the port h serves both for exhaust and the admission of part of the fresh charge. The oil enters from a pipe, N, connected with the oil supply, through a nozzle n into the ports n′, into which air is admitted through the port n″. The exhaust gases in escaping pass through the charge inlet port or nozzle h, which, extending over port n′, is similar in its action to an injector, thereby preventing the exhaust traveling down the inlet port.

The exhaust valve L is actuated by a cam, O, of suitable shape on the crank shaft e, and a spring, o′, on the spindle through a lever, O′, pivoted to the side of the casing A, with an adjustable arm, o, which engages the end of the valve rod L′.

The crank E is situated in the air chamber C and is connected to the piston by the crank rod E′, being actuated or rotated in the usual way therefrom, the rotary movement being transmitted to the fly wheel W on the crank shaft e. The side of the chamber C is made with a cover, C′, through which the crank disk E is inserted in position. At the opposite side of the chamber is a small shaft or spindle, P, rotated as the crank rotates by a drag link or connecting link, p, fitted to the crank pin, e′.

The eccentric g, by which the auxiliary piston G is actuated, is free to rotate around the shaft, and at one side is fitted with a boss with a ratchet notch, g′, therein. In the notch g′ a pawl or catch, R, carried around by the spindle P, engages and rotates the eccentric. Should the pawl R be thrown out of engagement, the piston G ceases to act.

On the end of the spindle P is placed a governor, S, which, as the speed varies, moves the pivoted lever S′ to and fro and with it the sliding piece s, with a projection, s′. When the engine is running at normal speed, the projection s′ on the sliding piece s is clear of the pawl R; but when running at an excessive speed the balls of the governor S expand and move

FIG. 4

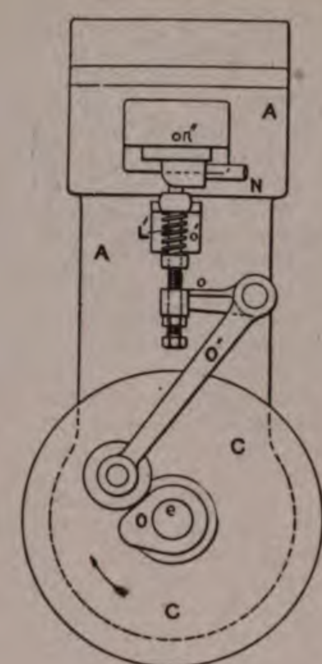


FIG. 3

the sliding piece s until the projection s' engages the tail piece of the pawl R and throws it out of the notch g', thus allowing the main piston D to make a stroke without the auxiliary piston G being moved.

The piston G stands when stopped by the governor at the bottom of its stroke, so as to leave port f' open and the crank chamber open to the atmosphere.

The auxiliary piston G performs the double function of a valve to admit air to the air chamber C and to draw the charge of oil and air into the main cylinder B.

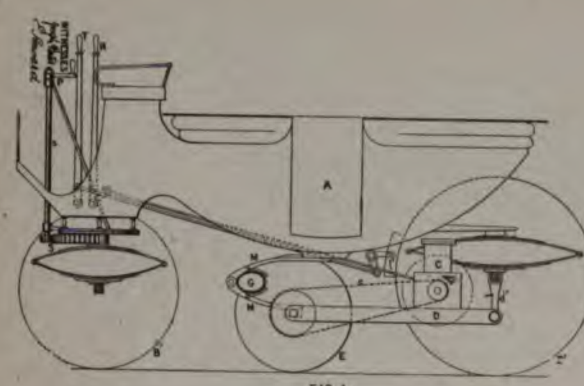
The operation of the engine is as follows: In the position shown in the drawings the main piston D has nearly completed its working or power stroke. The exhaust valve L is open, and the auxiliary piston G is near the end of its inward stroke, and the main piston has compressed the air contained in the air chamber C. As soon as the exhaust valve L is opened the heated gases of combustion pass through the charge heater K, carrying off any excess of heat from it before passing the exhaust valve L, leaving the charge heater K at a high temperature, as previously described. The compressed air in the chamber C, as soon as the upper ends of the ports c c' are uncovered, passes through them into the main cylinder B and expels the remaining products of combustion which have not escaped of their own pressure. As the piston D travels farther the lower ends of the ports c c' are closed by it, thus shutting off the crank chamber from the cylinder during the suction stroke of the auxiliary piston G. At the same time the piston valve M on the exhaust valve spindle L' is raised and closes the exhaust port l and the auxiliary piston G moves on sharply on its outward stroke. The outward stroke of the auxiliary piston G draws a charge of oil and air through the port h and charge heater K into the interior of the main cylinder before the main piston moves sufficiently far on its return stroke to close the upper end of the port c'. The exhaust valve L is then closed by the operation of the cam O on the crank shaft and the spring o', and the main piston D continues its return stroke, compressing the charge and drawing air into the chamber C through the port f', which has been uncovered toward the close of the outward stroke of the piston G. The combustible part of the charge is thoroughly heated and vaporized by the charge heater K as it is drawn in, and at the completion of the compression stroke of the main piston it is ignited and exploded, driving the main piston again forward. The auxiliary piston G, commencing its return stroke, closes the port f' as the main piston approaches the completion of its compressing stroke. While the main piston is dwelling at its inner dead center, the piston G makes the greater part of its return stroke, forcing the air in the cylinder F into the air chamber through the port f, thus increasing the amount of air compressed therein, which at the end of the power stroke rushes into the cylinder to force or sweep out the remaining exhaust gases. The governor acts by stopping the movement of the auxiliary piston G in such a position for one or more strokes when the speed is so high that air cannot be compressed in chamber C, and also preventing the drawing of a charge into the cylinder B.

When the vehicle is in use, or to start the same, the operator pushes forward on the upper end of the operating handle 18, and in so doing draws the connecting rods 23 forwardly, thereby actuating the rheostat arms of the motor. The motors being thus started will rotate in the usual manner, and as a result thereof the gear wheels 6 will be rotated to drive the rear wheels of the vehicle forward. As the motors operate at the same speed, the rear wheels will be driven forward at the same speed, and consequently the vehicle will travel forwardly in a straight line.

When it is desired to turn the vehicle, the operator engages the handle 21 and moves the same forwardly or rearwardly, corresponding to the direction in which it is desired to turn, and this movement rotates the sleeve 20 upon the operating handle 18, and the arms 22, carried by said sleeve 20, will be thrown into an angular position relative to the transverse position usually occupied by said arms, and this movement necessarily brings one of the rheostat arms forwardly and moves the opposite arm rearwardly, thus increasing the speed of one motor and proportionately decreasing the speed of the opposite motor. Thus one of the rear wheels of the vehicle will be driven at a greater speed than the opposite wheel and said vehicle will be turned. When the vehicle is running, the front wheels thereof act as caster wheels and will correspondingly follow all the movements of the rear wheels of said vehicle, and owing to the location of the spring 8 in the shafts that carry the front wheels the front portion of the vehicle will ride easily and there will be no great shock or vibration as said wheels pass over a rough portion of the road.

No. 644,950—Motor-Driven Vehicle.—John E. Thornton and James P. Lea, Altringham, England. Application filed Dec. 29, 1897.

In Fig. 4 the invention is shown applied to a four-wheel carriage, the body of which may be of any shape or design. In this case the frame D is provided preferably with only the single driving wheel E, as the front wheels of the carriage serve for steering and turning. One end of the frame D is connected to the back axle by connecting rods or links, d", and the other end is attached to the body of the vehicle by the two jointed levers or bracket arms M, and one end of the levers M being attached to the frame D and the other end to the vehicle. Between the ends of each of the jointed levers M is inserted pneumatic spring G, the tension of which is regulated by the amount of inflation. Instead of the pneumatic spring a volute spring, as in Fig. 1, may be employed. For four-wheeled vehicles we prefer the arrangement shown in



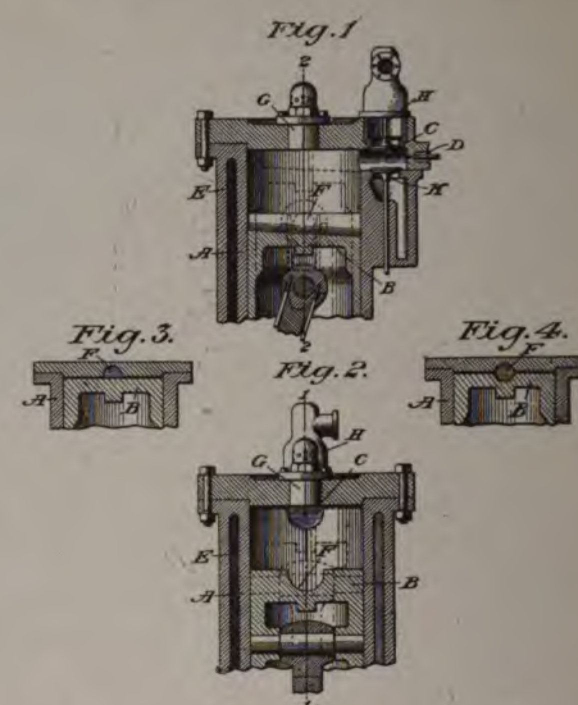


Fig. 4; but, if desired, the position of the frame D may be reversed, as shown in Fig. 1, the levers M being connected with the back axle. The driving wheel is actuated from the motor C by the chain e or other gearing. The vehicle is steered by the two front wheels B, which are swiveled by a quadrant, S, which is rotated in either direction by a pinion rod, s, and handle or lever, P. A hand lever, R, and connecting rod, r, control the motor C, and a brake lever, T, operates the brake t'.

In either arrangement the motor and driving wheel may be permanently connected with the vehicle to be driven, or the motor and driving wheel may be detachable from and attachable to each of several vehicles.

No. 644,798—Internal Combustion Engine.—Arthur J. Frith, of New York, N. Y., assignor to the Diesel Motor Co. of America, of New York. Application filed Oct. 23, 1899.

This invention relates to improvements in internal combustion motors of the Diesel type. These engines work on a four-stroke cycle, as follows: The combustion of fuel injected from the fuel valve gives a pressure on the inward stroke of the piston. On the next outward stroke the waste gases or products of combustion are expelled from the cylinder. On the next inward stroke the cylinder fills with fresh air drawn in from the atmosphere. This air is compressed on the succeeding outward stroke to a temperature sufficient to ignite the fuel, which is now injected from the fuel valve. Combustion of the mixture of air and fuel then ensues and the cycle recommences. For the successful operation of these engines it is essential that the temperature attained by the air in the cylinder during the period of compression on the fourth stroke of the cycle be high enough to cause ignition of the fuel when injected from the fuel valve. It is also important that on the introduction of the fuel uniform and complete combustion shall take place as quickly as possible. Owing to the large amount of relatively cooler metallic surface to which the air is exposed at this point and the proximity of the usual water jacket, the loss of heat between the time of compression and that of the admission of the fuel may become so great as to preclude a proper ignition. This may be compensated for by an excessive compression, but only at the expense of additional energy.

In the German engines it has been the practice to simply compress the air in the top of the cylinder, thus forming a cylindrical body of air exposed to the combined cooling effect of the entire cylinder end, the piston face, and a strip around the cylinder equal in length to the circumference of the cylinder and in width to the distance between the cylinder head and the piston face at the outer limit of the stroke. As the strip last mentioned is usually backed by a water jacket, it is readily apparent that the construction gives a very large amount of cooling surface per cubic inch of inclosed air. Now it is evident that if the metallic surface to which the air is exposed can be diminished, the detrimental cooling effect will be considerably lessened; and the objects of my improvements are to provide a clearance space in the cylinder of less surface area than has been hitherto employed and to afford facilities for the rapid introduction and ignition of the fuel. Other advantages will be apparent from the specification.

Fig. 1 represents a longitudinal section through the head end of an engine cylinder passing through the axis of the admission port, the section being taken on line 1 1 of Fig. 2, the crank end of the cylinder and adjacent parts of the engine being broken away. Fig. 2 is a longitudinal section at right angles to Fig. 1 on line 2 2 of Fig. 1. Figs. 3 and 4 show modifications, the scale being reduced.

A is the cylinder, B the piston, C the admission port, D the fuel valve, E the water jacket, G the safety valve, H the air admission valve, and K the escape valve, of an engine of the Diesel type. In the ordinary engine a considerable clearance is left between the face of the piston and the internal face of the cylinder head. In this engine the piston face at the outer limit of the stroke is brought in substantial contact with the cylinder head (see dotted lines in Figs. 1 and 2), so as to give practically no clearance at that point. Air space is provided for, however, by forming in the face of the piston a groove or channel, F, preferably semi-conical in shape (see Fig. 1), its axis in a plane passing through the axis of the admission port, with the larger end of the cone nearest such port. When the piston is at the top of the stroke this channel F aligns with the port C, and the entire body of compressed air is concentrated in this temporarily formed chamber or tunnel. As is apparent, a much less area of cooling surface is exposed per unit of cubical contents of air than in the ordinary form of clearance space.

The fuel emerges from the fuel valve D in a spray or jet of more or less conical shape and is at once surrounded by compressed air of a temperature considerably above its ignition point, its primary contact being with the very hottest portion of such air—namely, the central portion. Combustion immediately occurs and is uniform throughout the circumference of the cone. By reason of the long, narrow shape of the clearance space the particles of fuel mix more thoroughly and intimately with the air than in the older engines. The mixture of fuel and air is quickly projected across the piston, and the combustion is substantially simultaneous, not only throughout the circumference of the cone, but also throughout the length thereof.

In the former engines, where the fuel was introduced through a port in the head of the cylinder, the jet struck against the face of the piston and was deflected toward the sides of the clearance space before it could ignite. The objectionable feature of this method of introduction lay in the fact that the jet, striking the comparatively cold piston face, was apt to deposit carbon thereon, with a corresponding loss of the originally available energy. My improvement avoids this objection, for by its use the fuel has opportunity to move in a clear space entirely across the cylinder in the line of its entry before it can come in contact with any part of the metal cylinder or piston. The construction is therefore most perfectly adapted to prevent the deposition of carbon in any part of the ignition space.

In actual use it is found impossible to exclude entirely the air from between the adjacent plane surfaces of the cylinder end and piston face. Its amount is so small, however, as to exercise practically no harmful effect on the tendency of the fuel to ignite, since it bears but a small ratio to the large body of highly heated air in the channel F, and it is immediately reheated by the great heat evolved in the initial stages of combustion. As a factor in results it can therefore be safely neglected.

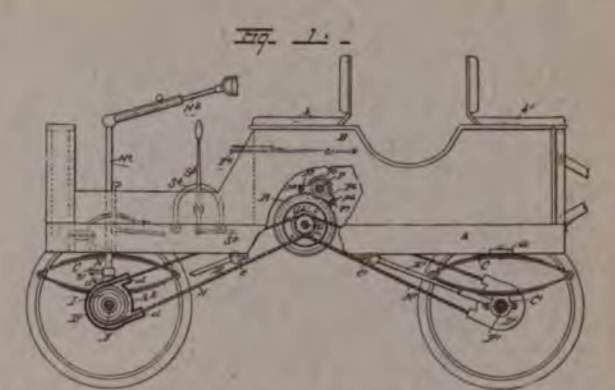
In Figs. 3 and 4 are shown modifications. The channel may be located entirely within the cylinder head or partly in the cylinder head and partly in the piston, the two channels uniting to form one channel at the time of combustion of the charge. Fig. 3 shows an engine with a channel entirely in the cylinder head, and Fig. 4 with the channel partly in the cylinder head and partly in the piston.

The inventor does not limit himself to a channel of a conical or semi-conical shape, though that form he believes to be preferable, since it corresponds more nearly to the shape of the fuel jet. Channels of a cylindrical, semi-cylindrical, polygonal or other shape he considers within the scope of his invention. It is desirable to make the channel and admission port of similar cross section so far as possible. The depth of the channel may be varied to provide greater or less compression, as desired.

No. 644,590—Motor Vehicle.—Hiram A. Frantz, Tamaqua, Pa., assignor of one-half to Elmer E. Brode, same place.

Fig. 1 is a side view. Fig. 3 is a horizontal sectional view of the axle casing and differential gear, and Fig. 3A is a vertical sectional view of one of the front wheels and its connection to the axle and casing. Figs. 4, 5, 6 and 7 show various parts in detail.

A represents the body or frame of the vehicle, which is carried on bolsters, a, secured to springs, C, which latter are carried upon seats, C′, loosely secured to the sleeves or casings D, inclosing the axles F F′. These axle casings are further connected with the rigid frame A of the machine by means of front and rear radius bars, E E′, which are pivotally secured to socket bearings, e and e′, respectively, on the frame



and connected to the axle casing D, as shown, by means of a screw sleeve, e^2, hinged at j to a collar, J, firmly secured thereto. The axes of these radius bars converge approximately toward the intermediately located transverse shaft G, from which motion is transmitted to the axles F F′, as will be hereinafter described. It will be noticed that this manner of connecting the axles to the frame A allows for convenient adjustment and also for both lateral and vertical movement of the body without materially changing the distance of either axle from the shaft G, the movement of the axles relative to the frame being controlled by the radius bars E E′, so as to swing in arcs practically coincident through the range of movement required with those having the shaft G for a center.

The forward chain H is divided at the center into two parts, F F′, each of which is driven by the chain wheel h^2 through bevel gears, i′ i′, loosely mounted on a spindle, i, which is rotated with the gear frame I and chain wheel h^2, said loose bevel gears i′ i′ engaging with fixed bevel gears d′ d^3 on the axle parts F F′ and being spaced on the spindle i by a collar, i^2, into which the abutting ends of the axle parts may extend. The whole of this gearing and the axle parts themselves are inclosed by a casing, D, which is of spherical form at the center, with a suitable opening, d^6, closed by a cap, D^2, having chain openings, d d, and within the cylindrical portions D of which said axle parts are suitably mounted upon rollers at d^4 d^5 for rotation therein, the casing itself being secured to the frame of the machine, by means of the radius bars E and springs C.

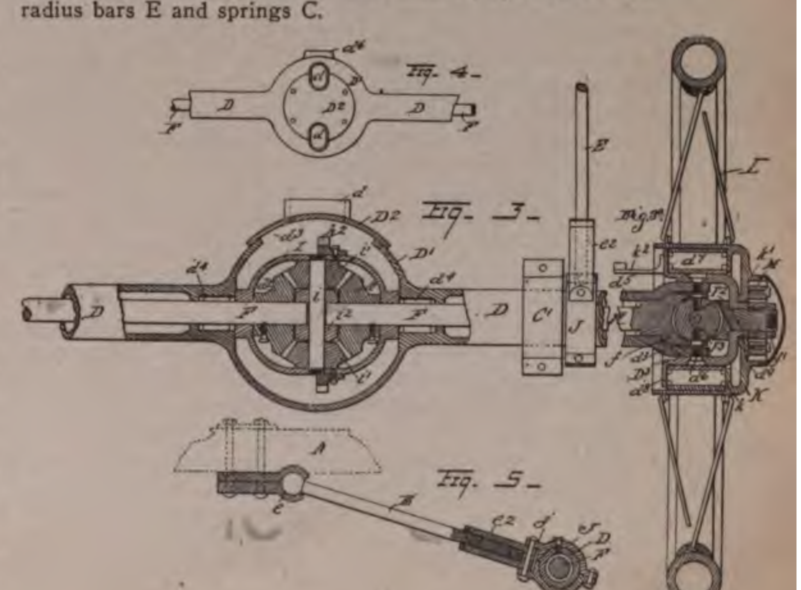
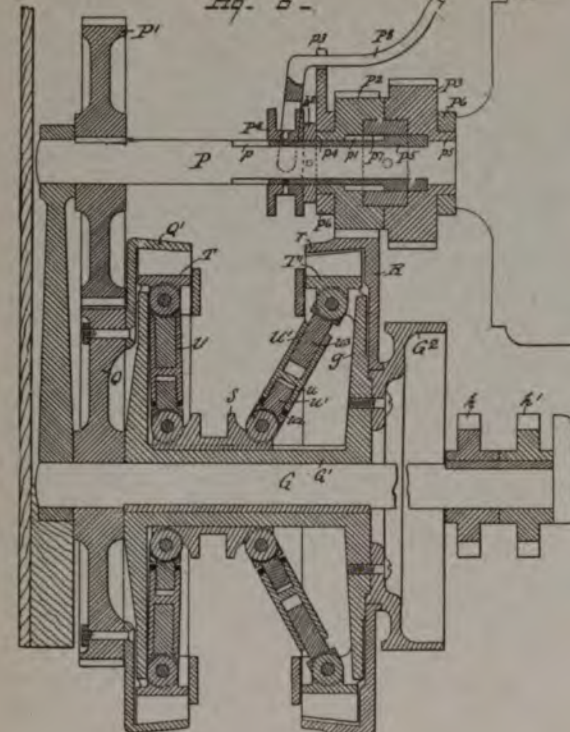


Fig. 5



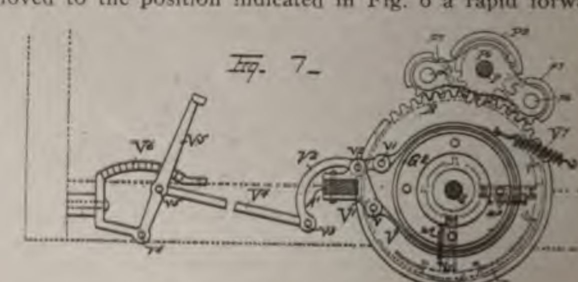
The wheel L is provided with a hollowed out hub, which incloses the pivoted extension D^3 of the casing D and rotates thereon upon a series of rollers, d^7, located between flanges d^8 of the casing extension and k of the wheel hub, the reduced portion k′ of which latter bears upon the reduced hub d^9 of the casing extension D^3, with which the wheel is maintained in alignment when held thereon by means of the axle nut f′. The latter is threaded upon the end extension F^2 of the axle F, which is connected by a universal joint, F^3, to the bifurcated end f of the main axle F. A ratchet and pawl engagement is provided at M between the axle extension F^2 and the hub K of the wheel, which is thus caused to rotate with the axle, while at the same time it is capable of adjustment to any required angle with relation to the main axle and casing for the purpose of steering the vehicle.

The rear axle, wheels and axle casing are similar in construction to the front, except that the wheels are rigidly secured to the axle, there being no necessity for adjusting them for steering, as in front, and the axles being consequently made in two sections only instead of four, and the casing in one section only instead of three, the end sections of the front axle and casing and the universal joint connection being omitted.

Reverting to the shaft G, from which motion is transmitted to the axles, as described, it will be noticed that it is itself driven from a main shaft, P, to which any preferred form of motor may be applied. To this shaft P is fixed a gear wheel, P′, which meshes with a gear wheel, Q, loosely mounted on the driven shaft G and provided with a rigidly secured friction wheel or circular flange, Q′, through which the motion of the gear wheel Q may be transmitted to the shaft G by means of a clutch mechanism consisting of a sleeve, S, arranged to slide axially upon a flange sleeve, G′, keyed to the shaft, said sleeve S carrying friction shoes, T, adapted to be pressed into engagement with the friction wheel extension Q′ of the gear wheel Q, as hereinafter described.

In order to provide for driving the shaft G at a slower speed relative to the main shaft P than is transmitted through the fixed gear wheel P′ and also to provide for reversing the rotation of said shaft G without reversing that of the main shaft, upon the latter is mounted a pair of smaller gear wheels, P^2 and P^3, of somewhat different diameters, arranged contiguously, and either of which may be caused to rotate with the shaft P by means of keys, P^5, feathered to the shaft and movable axially by means of a grooved sleeve, P^4, to which they are secured, this sleeve P^4 being engaged by a rod, P^6, which is operated by a conveniently located hand lever, P^9, as shown. These keys P^5 move loosely in axial grooves provided in a collar, P^7, which is fixed to the shaft, and upon which both of the gear wheels P^2 and P^3 are partly mounted, both being recessed from their abutting faces, so as to inclose said collar. Each gear wheel is also provided on its outer face with a projecting hub, p^4 or p^5, and upon these hubs are loosely mounted parallel plates, P^8 P^8, which extend laterally beyond the gear wheel P^3 and are rigidly connected by axles p^6 p^6, upon which are loosely carried between the plates pinion wheels p^7 p^7, which mesh with the wheel P^3 and are also wide enough to mesh at the same time with a gear wheel, R, on the shaft G, with which the gear wheel P^2 also meshes. This gear wheel R is loosely mounted upon the flanged sleeve G′ and is provided with a circular friction flange, r, similar to Q′ on the gear wheel Q, the inner periphery of which is adapted to be engaged by friction shoes, T′, in the same manner as the friction wheel or flange Q′ is engaged by the shoes T, previously referred to. Each of these two series of friction shoes T and T′ is connected to the clutch sleeve S by a corresponding series of connecting rods U or U′, each rod being pivoted at one end to a friction shoe and at the other to the clutch, so as to form a double clutch arranged to operate by means of a single sliding sleeve upon either of the friction flanges Q′ or r. Each of these connecting rods is made adjustable as to length by means of a screw-threaded part, u′, engaging the tubular body u of the rod, and a jam nut, u^2, to lock it in adjusted position, and is also made extensible under strain by employing a telescope connection between the opposite jaw part u^3 and the tubular body, with a spring, u^4, arranged to keep said parts in engagement. The shoes T T′ have a limited radial movement in suitable guideways or pockets formed within the friction flanges Q′ and r, and the effect of moving the sleeve S in either direction from a central position upon the shaft sleeve G′, in which position both of the gear wheels Q and R are rotated loosely and without effect upon the shaft G, is to produce a frictional engagement between one or other of said gear wheels and the shaft G. Thus, when moved to the position indicated in Fig. 6 a rapid forwardly

Fig. 7

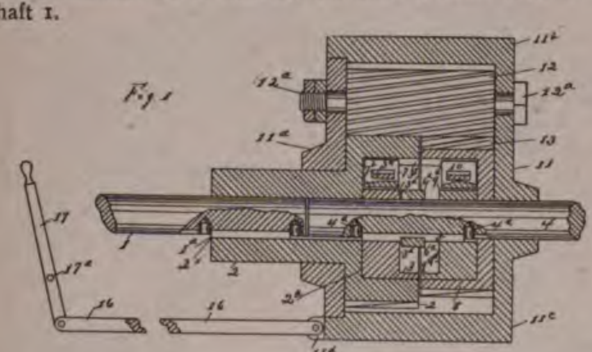


rotating movement of said shaft is transmitted through the gear wheel Q. If moved in the opposite direction, a slower movement is transmitted to the shaft through the gear wheel R, the direction of which is determined by the position of the reversing mechanism P^4 P^5. The sleeve S is operated by means of a forked end lever, S', which is pivoted to a fixed point, S, of the frame and connected by means of a rod, S^2, to a hand lever, S^3, having a locking quadrant, S^4.

No. 644,508—Propeller Reverse Gear.—Franklin A. Errington, New York, N. Y. Application filed Aug. 27, 1897.

A driving gear wheel, 2, is connected to rotate with and to slide upon an engine shaft, 1, by a spline, 1a, meshing with a groove, 2X. The inner face of the wheel 2 is recessed to provide an axial clutch chamber, 2a, within the plane of said inner face to receive a friction wheel, 3, the periphery of the friction wheel 3 forming a friction band split by a slot, 3a, into two sections, 3b 3c, to permit said friction band to be expanded against the side walls of clutch chamber, 2a. A propeller shaft, 4, is shown axially socketed in wheel 2, and the friction band 3b 3c is connected to said shaft by an arm, 3d, which is provided with a bore located axially to the periphery of wheel 3. The propeller shaft 4 is grooved to receive a spline, 5, held from longitudinal movement along shaft 4 by pins 4a. The middle portion of spline 5 is cut down level with the periphery of shaft 4 to receive a collar, 6a, of a wedge, 6, by which construction the collar is held from end movement upon shaft 4. One side of one end, 6b, of wedge 6 rests against arm 3d, and the other side of end 6b engages the point of application, 7a, of a lever, 7. One section, 3b, of the friction band is provided with a fulcrum, 3m, having a supporting step, 3a, which meshes with an aperture, 7b, in lever 7 and supports said lever 7 in operative position in slot 3a, and the other section, 3c, of the friction band is provided with a resistance face, 3s. By this construction the advance of the end 6b of wedge between the lever 7 and arm 3d forces the fulcrum 3m away from the resistance face 3s to expand the friction band 3b 3c against the side walls of clutch chamber 2a to connect the shaft 4 with wheel 2 and shaft 1.

Fig. 1



A reversing wheel, 8, surrounds the propeller shaft 4 and is provided with a clutch chamber, 8a, a friction wheel, 9, having an arm, 9d, and a lever, 10, the friction wheels 3 and 9 being both splined to turn with and slide upon shaft 4 and the other end 6c of wedge 6 being adapted to expand friction band 9b 9c against the side walls of clutch chamber 8a in a similar manner to that above explained to connect the shaft 4 with reversing wheel 8.

The peripheries of wheels 2 8 are preferably provided with spiral gear teeth to secure maximum strength and smooth running. A cover, 11a, surrounds hub of wheel 2, and a case, 11, incloses wheels 2 8 and is attached to cover 11a.

Fig. 4

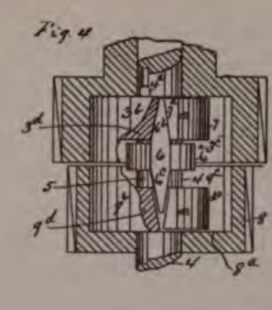


Fig. 3

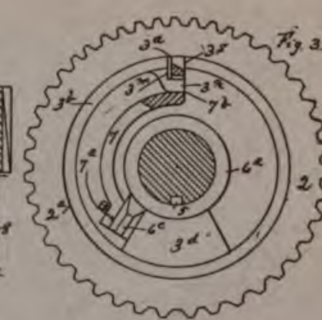
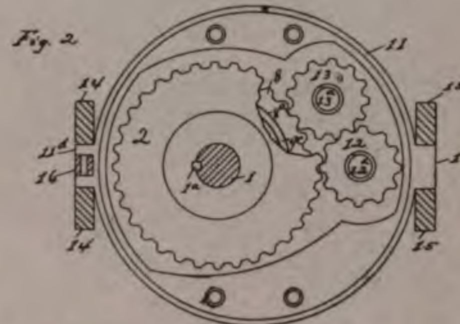


Fig. 2



Bolts, 12a 13a, pass through said case 11 and cover 11a. A double-depth transmitting pinion, 12, is journaled upon bolt 12a and meshes with driving wheel 2. A reversing pinion, 13, is journaled upon bolt 13a and meshes with the reversing wheel 8 and also with transmitting pinion 12. The use of spiral gear teeth is particularly desirable to give as many wheel teeth in mesh with the pinion teeth as possible with pinions of minimum diameter. The case 11 is shown provided with lugs, 11b 11c, to mesh with slide blocks, 14 15. An eye, 11d, is provided to afford connection of case 11 with a connecting rod, 16, which is operated by a lever, 17, fulcrumed upon a pin, 17a, to move said case 11 along the shafts 1 4 to operate the friction wedge lever mechanism to connect the shaft 4 with either the driving or reversing wheel. The recessed clutch chambers 2a 8a enable the internal parts of the device to hold themselves from end movement with relation to the case 11 11a. By the above construction the case 11 will be non-rotative, and the rotation of wheel 2 in one direction through the medium of pinion 12 13 and all the parts inclosed in case 11 11a will be longitudinally movable upon the shaft 4 with the exception of spline 5 and wedge 6.

The operation of the parts is as follows: When it is desired to rotate the propeller shaft 4 in one direction, as to the right (or ahead), the case 11 is moved back by means of lever 17 to force the end 6b to wedge 6 between the arm 3 d and the point of application, 7a, of lever 7, and the propeller shaft 4 will thereby be connected to rotate with shaft 1 through the medium of wheels 2 3. When it is desired to stop the propeller shaft 4 without stopping the engine shaft 1, the case 11 is moved forward sufficiently to relieve the frictional contact of wheels 2 3. To rotate the propeller shaft 4 in the opposite direction to engine shaft 1, the case 11 is moved forward to force the end 6c between the arm 9d and lever 10, which connects the shaft 4 with wheel 8, which is continuously rotated in the opposite direction to wheel 2 and shaft 1, as aforesaid.

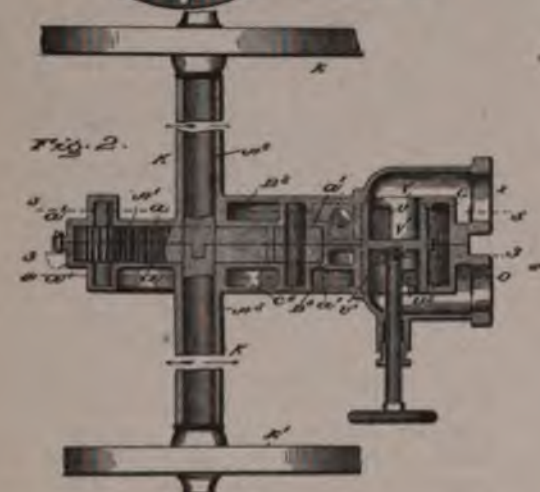
The inventor claims that the principle of this invention is also applicable to motor vehicles.

No. 645,378—Motor Vehicle.—William O. Worth, Chicago, Ill., assignor of two-thirds to William R. Donaldson, Louisville, Ky., and Henry W. Kellogg, Battle Creek, Mich.

The object of this invention is to enable the wheels of the vehicle, and more particularly the rear wheels, to be driven uniformly when the vehicle is going straight forward, or to allow one wheel to rotate faster or slower than the other, as may be necessary in turning curves, without straining the axle or the motor. The motor, it is claimed, constitutes virtually a compensating driving gearing, which allows one section of the axle to turn independently of the other, if necessary, although imparting a uniform rotation to both sections of the axle if the motor is going directly forward.

Fig. 1.

Fig. 2.



The subsidiary objects of the invention are to do away with the necessity for compensating beveled gearing, and to afford an independent motor for each wheel mounted on the axles, said motors being confined in one casing and controlled by a single valve mechanism.

Fig. 1 is a horizontal longitudinal section through the motor and rear axle. Fig. 2 is an enlarged vertical longitudinal section on line 2 2, Fig. 1. Fig. 3 is a similar section on line 3 3, Fig. 2. Fig. 4 is a similar section on line 4 4, Fig. 2. Fig. 5 is a similar section on line 5 5, Fig. 2.

The motor is constructed substantially as that shown and described in application for patent for motor and reversing valve mechanism therefor, No. 719,937. Instead of a solid central shaft, however, in this case an axle or main shaft is used, which is formed in two sections, A^2 and A^3, which meet in the central vertical line of the motor, and upon the meeting ends of the sections are keyed large gears, a, which occupy a chamber, A', within the motor casing and respectively mesh with small gear pistons, a' a', each pair of gear pistons occupying diametrically opposite working chambers, A', within the casing.

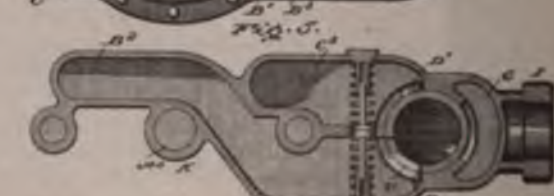
B C are fluid chambers, respectively above and below the rear gear pistons a', and C' B' are like fluid chambers, respectively above and below the forward gear pistons a' a'. The chambers B B' communicate at the left-hand side of the casing with a passage, B^2, which opens into the main valve chamber in the front of the casing through a port, D. The chambers C C' communicate with a passage, C^2, at the right-hand side of the casing, which communicates with said valve chamber through a port, d, Fig. 3. Chamber B' also communicates at the right-hand side of the casing with another passage, B^4, which communicates with the valve casing through a port, d', and chamber C' communicates with a chamber, C^3, at the left-hand side of the casing, which communicates with the valve chamber through a port, D', Fig. 5. The main valve V is a cylinder having a central imperforate partition, V', that divides the valve into two parts, the left-hand side communicating with an inlet, I, and the right-hand side with an outlet, O. At the inlet end of the valve, in the side wall thereof, is a port, v, which is adapted to register with either port D or D', and at the right-hand end of the valve, in the wall thereof, are ports v' and v^2 respectively, adapted to register with ports d and d'. If the fluid is primarily admitted into chambers B B' th: gear piston a' will be rotated in the direction of the tailless arrows, and consequently will rotate the axle sections A^2 A^3 in the direction indicated by the tailless arrows in Fig. 2. On the other hand, if the fluid be primarily admitted into chambers C C', the gear pistons will be driven in the direction indicated by the tailed arrows in Fig. 3, and the axle sections will consequently be rotated in the direction indicated by the tailed arrows in Fig. 2.

The operation may be, possibly, more readily understood if it be considered that the left-hand piston a' was omitted and only the one piston used—i. e., that at the side next to the valve. In that case it will be seen that the fluid when the engine is going in the direction indicated by the tailless arrow passes through ports v and D into the left-hand passage B^2.

Fig. 3.

Fig. 4.

Fig. 5.



flows into chamber B′, rises, forcing around piston a′ into chamber C′, passes to the right-hand side of the casing into the passage C^4, and escapes through ports d and v′ to the outlet, or, if the valve V be shifted so as to register ports v and D′, the fluid passes first into the left-hand passage C^3, then to chamber C′, then flows down, turning piston a′ in the directions indicated by the tailed arrows; enters chamber B′, flows to the right end thereof into passage B^2, and escapes through ports d′ and v^2 into the outlet.

If it is desired to stop the motor at any time, valve E is turned until ports v v^2 or v v′ register with by-pass G, when, while circulation of fluid within the motor proper is stopped, circulation of fluid from the inlet I to outlet O can continue uninterruptedly.

By reference to Fig. 2 it will be obvious that if the gears a a were rigidly connected the axle section A^5 A^6 would move as one, and consequently great torsional strain would be put thereon if the vehicle was being turned; but by having gears a a separate and mounted side by side upon the meeting ends of the axle sections A^5 A^6 and meshing them with the independent loosely journaled gear pistons a′ a′, it will be obvious that either axle section can be rotated independently of the other in turning, and while one gear, a, and its gear piston, a′, in each pair can slow up the other one can go ahead at increased speed, and thus a uniform quantity of fluid can be passed through the working chambers while the vehicle is turning, and the power applied to each axle section will be just such as is necessary to speed it properly. As soon as the vehicle resumes a straight course, however, both gear pistons a′ will rotate synchronously and drive the axle sections uniformly.

In order to keep the axle sections in proper alignment and to support the motor thereon, the motor casing is provided with lateral sleeves, K K, which extend out to the hubs of the wheels, so as to exclude dust from the working parts of the motor and form rigid supports for the axle sections.

In the construction shown the vehicle wheels k k′ are fast on the outer ends of the axle sections A^5 A^6.

G represents a by-pass by which the fluid may be short circuited from the inlet I to outlet O when the motor is shut off.

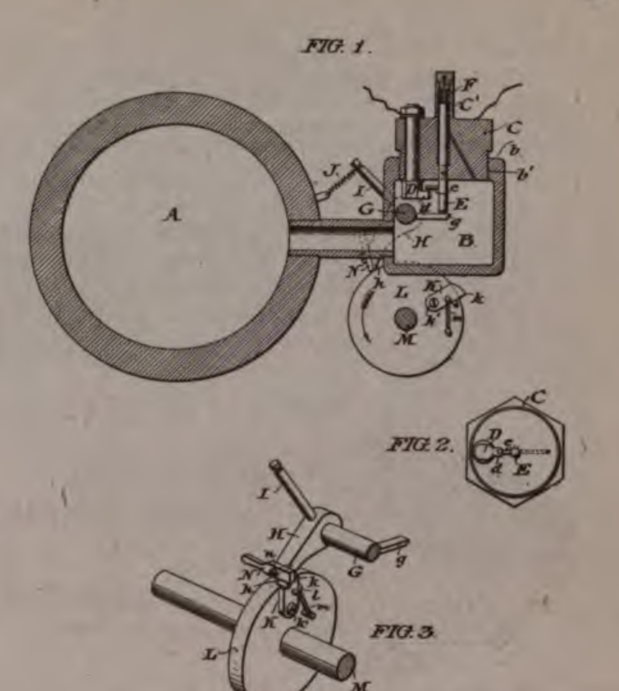
No. 645,312—Friction Clutch.—Albert De Dion and Georges Bouton, Puteaux, France. Application filed June 17, 1899.

This invention was illustrated and described in our last issue.

No. 645,458—Oil Distributing Means for Oil Engines.—Louis Charon and Frederic Manaut, Paris, France. Application filed June 3, 1899.

No. 645,398—Igniter for Explosive Engines.—Lewis Jones, Jr., Philadelphia, Pa. Application filed June 22, 1899.

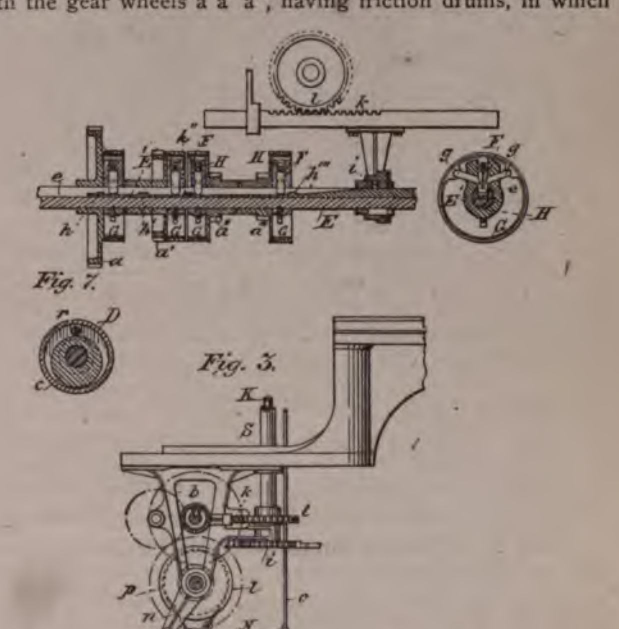
Claim.—In an igniter for an explosive engine, the combination with a gas chamber, having a screw-threaded aperture, an electrical terminal fixed in said plug in eccentric relation with said thread, means to insulate said eccentric terminal from said plug, an electrical terminal mounted to slide in said plug in concentric relation with said thread, a tubular extension of said plug, exterior to said gas chamber, inclosing said slidable terminal, a spring, arranged in said tubular extension, to thrust said slidable terminal inwardly, a rock shaft provided with a tappet extending within said chamber, in registry with said concentric terminal, a spring, operatively related to said shaft, to normally uplift said concentric terminal, by means of said tappet, a second tappet upon said rock shaft, exterior to said gas chamber, an adjustable supplemental bearing member, pivoted upon said exterior tappet,



a rotary cam disk, a cam piece eccentrically pivoted upon said cam disk, in operative relation with said exterior tappet, a stop upon said cam disk, and a spring to normally maintain said cam piece against said stop.,

No. 645,497—Motor Vehicle.—Hugo Stommel, Plainfield, N. J., assignor to the U. S. Standard Motor Vehicle Co., of New Jersey. Application filed Aug. 5, 1898.

Claim.—In motor vehicles the countershaft E, provided with the gear wheels a a′ a″, having friction drums, in which



are placed circular springs, G, that are operated by a sliding piece, F, pivoted dogs, g g, and by means of a sliding rod, E′, having projections, h h′ h″, in combination with a gear wheel, a‴, and a projection, h‴, for reversing the action of the vehicle.

BALDWIN DETACHABLE AUTOMOBILE CHAINS

are made in sizes to suit the demands of the trade. Our new roller chain is especially adapted for light Motor Vehicles.

SEND FOR CATALOGUE.

K. FRANKLIN PETERSON, Sales Agent,
205 Lake St., Chicago, Ill.

BALDWIN CHAIN CO., WORCESTER, MASS., U. S. A.

KITTS LOW WATER ALARM

FOR YOUR LOCOMOBILE.

Avoids all Danger. Write for Blue Print and Price.

KITTS M'F'G CO., Oswego, N. Y.

Are you Building a Motor Carriage? If so, send $2.00 for detail and assembled drawings of complete Running Gears, with latest construction of steering, equalized axles, etc., with all dimensions and particulars.

Address MOTOR DESIGN CO., BUFFALO, N. Y.

STEAM VEHICLE FITTINGS.

PIN Valves (both union and plain ends). Injectors, Gasoline Regulators (improved type), Water Regulators, Improved Glass Gauges, Globe and Check Valves, Water Relief Valves for Cylinders, Steam Gauges and Safety Valves.

LOCKE REGULATOR CO., - - Salem, Mass.

FRICTION-LOCK

REVERSE GEAR FOR AUTOMOBILES AND LAUNCHES.

Patent for sale. Apply **F. A. ERRINGTON,**
39 CORTLANDT STREET, NEW YORK.

FOR SALE.

Several gasoline motors, 1½ and 2 h. p., horizontal or upright. Weight 90 lbs., compact and perfect in every detail. Also 1½ and 2 h. p. Marine Motors which are new and ready to run. For prices write to
J. S. THIELL, 22 State Street, Troy, N. Y.

FOR SALE.

Genuine De Dion Bouton Motor Cycle. Imported last fall. Speed, 35 miles; weight, 200 lbs.; power, 2½ horse. Inspection and offers invited.
Address 81 Seventh Avenue, Brooklyn.

OIL— DISCARDED!

A manufacturer of Hydro-Carbon Engines says:

"We have used Dixon's Graphite in our cylinders for nearly a year and find it superior to any other, and entirely satisfactory. We believe we have detected some new and valuable results through the use of Dixon's Graphite. Not only is perfect lubrication established, but the presence of the Graphite greatly reduces the resistance between the sparking points."

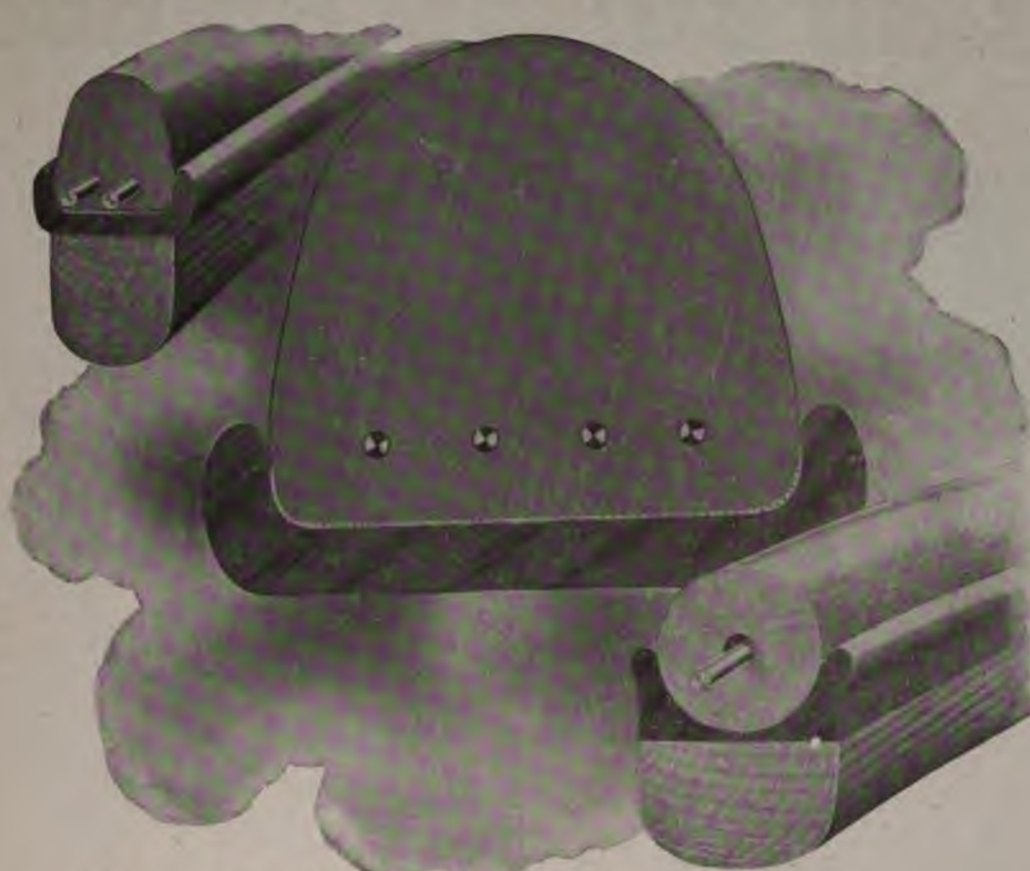
SAMPLE FREE IF DESIRED.

Joseph Dixon Crucible Co.

JERSEY CITY, N. J.

YOU have all heard of DURYEA vehicles. They have been before the public for more than five years, having won the Times-Herald race at Chicago on Thanksgiving Day, 1895, in 15 inches of snow; first prize $2,000. They won the Cosmopolitan race at New York on Decoration Day, 1896, being the only vehicles to return to the city the same day; all prizes $3,000. They won the London to Brighton run November 14th, 1896, over some fifty competitors, including the winners of the first three prizes in the Paris-Bordeaux race. They also won first and second place in a 100 kilometer race on November 13, 1899, in Belgium, being beaten by a special racing machine only and proving themselves superior to a dozen competitors, including 5 Panhards. All these machines were ordinary road machines and were afterward sold to customers and put into every-day use. We have never built a racing machine nor do we believe that the public wishes to purchase racing machines. We know that they do desire a light, simple, reliable, high-powered, high-speeded road machine, suitable for good roads or bad, and capable of taking hills, mud, sand and snow as they are commonly found in this country of bad roads. If you wish to know more, kindly write to

DURYEA, READING, PA., or PEORIA, ILL., or LOS ANGELES, CAL.



GASOLINE TRICYCLES

ASTER MOTOR.

Quadricycles, and Pacing Tandems, propelled by the famous De Dion or Aster Motors. We supply either.

"AUTOGO." MOTOR QUADRICYCLE.

Write for Prices and Agencies.

WALTHAM MFG. CO.,

WALTHAM, MASS.

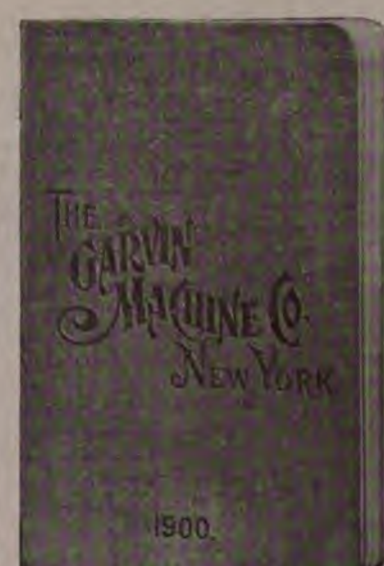
ANGLO-AMERICAN STOCK JOBBERS.

SOMETHING about the London History of Pennington and Lawson Leaders of the 75,000,000 Dollar American Promoting Expedition.

ISSUE OF FEBRUARY 7TH.

10 Cents, Stamps or Coin.

THE HORSELESS AGE
150 NASSAU STREET,
NEW YORK



New Catalogue

OF...

THE GARVIN MACHINE CO.

Now Ready For Distribution

PRESENTS IMPORTANT IMPROVEMENTS

Yours for the Asking

The Garvin Machine Co.,

Varick and Spring Streets,
NEW YORK...

SALES AGENTS:

The Garvin Machine Co., 51 N. 7th St., Philadelphia, Pa.
Manning, Maxwell & Moore, 22 S. Canal St., Chicago, Ill.
Deutsche Garvin Maschinen-Fabrik, Aktiengesellschaft, 17 Burg Strasse, Berlin C., Germany.
C. W. Burton, Griffiths & Co., Ludgate Square, Ludgate Hill, London, E. C., England.
Montgomery & Co., 28 Boulevard Magenta, Paris, France.

DO you know why the DURYEA System pleases the people? LIGHT WEIGHT. Cyclers know, railroaders know, teamsters know and you know that light weight in a vehicle is a valuable feature. Fifty-pound cycles were soon out of date and 25-pound ones are now universal. The one-horse dray, like the small railway car, has been replaced by vehicles carrying larger paying loads in proportion to their weight. American light buggies are familiar the world over and American automobiles are soon to be. Light weight, long range, high power, simple mechanism, artistic design and easy control are what you require. DURYEA vehicles meet these requirements. A hundred-weight per horse power tells the story This is why they are able to traverse mud, snow, sand, hills or even plowed fields with facility. Light weight with high power means proper proportions. DURYEA vehicles are the result of constant experimenting since 1891. In one you get many details proven valuable during these years. Four-passenger rigs weigh less than a horse and can travel faster and farther A triple cylinder motor insures light weight, steady running, little noise or vibration and great certainty of action. Simple mechanism. No counter-shafts. No gears running at ordinary speeds. Single central control operated from either side at will. **PRICE, $1,250.00.** If you are interested write to

DURYEA, READING, PA., PEORIA, ILL., or LOS ANGELES, CAL.

HYDRO-CARBON SYSTEM.

SOMETHING NEW

A Motor Vehicle With Space in Back for Carrying Packages, Etc.

If you desire the **simplest, most easily understood** and **managed** motor vehicle ever offered, write

ST. LOUIS MOTOR CARRIAGE CO.,

MANUFACTURERS OF COMPLETE VEHICLES ONLY. **St. Louis, Mo., U. S. A.**

A PERFECT **AUTOMOBILE** EQUIPMENT.

THE

EMPIRE BALL-BEARING AXLE

AND

ROBERTS' WHEEL.

PATENTED.

A fine axle, thoroughly tested by actual use under all classes of vehicles, giving perfect satisfaction.

Especially adapted to automobiles and heavy trucks. Names of users and testimonials furnished on application.

NONE SO NEAR ANTI-FRICTION.

SUPERIOR TO ANY OTHER AXLE FOR ALL KINDS OF

MOTOR VEHICLES.

AXLE DEPARTMENT.

THE CHICAGO SCREW CO., - - CHICAGO, ILL.

Address all communications to the Company. Send for Catalogue.

EXPLOSIVE MOTOR NUMBER

JANUARY 17TH, 1900.

LEADING ARTICLES ....

The Hydrocarbon Engine as a Source of Energy, by Elwood Haynes.
General Deductions, by Henry W. Struss.
The Gasoline Engine Indicator Diagram, by E. C. Oliver.
Vaporizers and Carbureters, by Herbert L. Towle.
Ignition and Ignition Troubles, by P. M. Heldt.
Coils and Sparks, by E. J. Stoddard.
The Vibration of Explosive Motors, by Herbert L. Towle.
Gasoline and Gasoline Mixtures, by E. J. Stoddard.
Multi-Cylinder Engines, by P. M. Heldt.
Gasoline Vaporizers and Carbureters, by Henry W. Strüss.
Balancing a Motor Carriage, by E. C. Oliver.
Explosive Motor Data, by R. I. Clegg.
An Explosive Motor in Detail, by R. I. Clegg.

72 pp. PRICE, 10 CENTS, Stamps or Coin.

SUBSCRIBE FROM JANUARY 1ST, AND YOU WILL GET THIS NUMBER. **$2.00 A YEAR.**

The Horseless Age,

150 NASSAU ST., NEW YORK.

STEAM IS THE BEST POWER FOR AUTOMOBILES

Steam Motor Wagon.

THIS STYLE NOW READY.

OTHER STYLES TO FOLLOW.

THE Carriage illustrated here is one that will satisfy the most critical, for in it is combined the finest carriage work and the best machinist skill and workmanship, and it is the most practical and satisfactory pleasure carriage one can have.

FOR FULL PARTICULARS AND PHOTOGRAPH ADDRESS

STANLEY MANUFACTURING CO.,

No. 117 LINCOLN STREET, BOSTON, MASS.

DIAMOND TIRES...

DIVIDE YOUR ORDERS

WE DESIRE COMPARISON

OUR CONSTRUCTION ORIGINATED WITH US

IMITATORS OFFER INDUCEMENTS IN PRICE

RESULT WE LEAVE TO YOU

DIAMOND RUBBER COMPANY

AKRON O.

purpose or whether handy little ladders are carried in each vehicle; but we suspect that the mast feature is likely to undergo modification before single-track lines on this system are extensively patronized.

What of Maintenance?

When will electric vehicle promoters tell the public something about cost of maintenance? Even before scientific societies, where it would seem that the associations might encourage frankness, the same partial statements are made in regard to the cost of operation of the electric vehicle. Cost of current, stabling, insurance and interest on first cost are the only items included in the schedule, while the renewal of plates and the constant skilled attention which vehicle batteries require are glossed over or omitted entirely from the summary. Do these gentlement imagine that they can fool all the people all the time? Perhaps they think that if they should tell the truth it would hurt "the business." So it would; but it would help the industry.

Necessity of Wire Gauze.

We have received from our readers quite a number of letters in addition to those published on the cause of the carbureter explosion recently referred to in our "Communications" columns. All are in agreement that the probable cause was a failure to provide the usual wire gauze in the inlet pipe to prevent a back fire in case of the valve not closing properly. Will our correspondent please tell us whether he used the gauze or not?

The Performance of Small Gas Engine Cylinders.

By Herbert L. Towle.

Every steam engineer knows that the fuel record of the engine that runs the factory is no criterion of the steam which will be made away with by the little insatiate that drives the blower. The small gas engine has not so black a record, but its performance is still far behind that of its medium and large sized counterparts: and within the scope of our present knowledge there is no great hope of revolutionizing it.

It is, of course, well known that the larger cooling area presented by the walls, relatively to the volume they inclose, is the cause of at least the larger part of this loss of efficiency; but this fact is much further-reaching than is often supposed, and there could ordinarily be no greater mistake than to make the small cylinder, in its stroke proportions, degree of compression, and time of ignition, a counterpart of the large one. The gas engine is primarily a piece of chemical apparatus; and only after the carefully proportioned and commingled charge has been drawn in, compressed to the requisite degree, ignited and burned, does the engine become a mechanical agent for transforming the energy thus set free into work. The engine is indeed a piece of mechanism, but it is mechanism designed to a chemical end, and the first business of the designer is to effect the chemical reaction under conditions the most advantageous possible.

We have to effect, first, the ignition of some portion of our mixture of gasoline and oxygen molecules; secondly, the spread of the flame thus stated to all parts of the charge; and finally, to utilize the resulting energy with as little loss as may be feasible. There are four things on which the readiness of the first ignition depends: the correctness of the mixture's proportions, the pressure to which it is subjected, its temperature, and the temperature and perhaps the size of the igniting agent. Ignition once effected, the flame will propagate with a rapidity determined by the temperature of the charge; its pressure; its richness, and its homogeneity. Theoretically, the ignition should be as prompt and the inflammation as rapid as possible, in order to utilize to the utmost the subsequent expansion; and in medium and large gas engines improved economy is to be sought along these lines. But in the small engine, while the ignition can never be too prompt, it is possible to have both too high a compression and too rapid combustion, and while there are mechanical reasons for both, the principal reason is physical.

A practical obstacle to high compression in a carriage motor is perhaps the enhanced difficulty of starting; but this is so readily and cheaply overcome by a starting cam as hardly to be worth the attention sometimes given it. A more serious drawback is the added fly wheel weight required and the general wear and tear which call for more careful design and more frequent attention by the user. Again, the higher the compression the greater will be the leakage past the piston rings; and the ratio of cylinder volume to circumference of piston decreases very rapidly as the diameter is reduced. The leakage, of course, will be least at high speeds, and greatest when starting, since the charge has then abundant time to leak away. It is quite possible to make the clearance space in a small and short-stroke motor so small that the engine cannot be started at all, even with carefully fitted rings and copious libations of cylinder oil.

The principal reason, however, why the compression cannot be made as high in a small as in a large cylinder is that it is necessary to prolong the combustion. Taking the water-cooled motor first, it is well known that a large proportion of the heat lost to the jacket goes in the instant after ignition, while the crank is still near the center. The high temperature of the flame, the density of the gaseous strata transmitting the heat, and the relatively large cooling surface of the walls and head, all contribute to this result; and in small cylinders the last named factor assumes an influence so disproportionate as quite to nullify, in most cases, the advantage theoretically to be gained. The heat is produced, comparatively speaking, all at once; and it is lost before there is time to convert it into work. Under such conditions, to increase the compression merely entails all the inconveniences of added fly wheel weight, greater leakage and more rapid wear and tear, with no compensating gain in economy. A moderate compression, on the other hand, gives a lower initial pressure, with the charge perhaps hardly half burned, when the piston begins to move out; but the combustion continues till well along in the stroke, resulting in a full expansion curve whose net area is quite equal to the other.

If the cylinder head be unjacketed, there is less loss of heat there; but care must be had lest the head become overheated and cause spontaneous ignitions of the charge. Those motors whose walls, as well as head, rely on radiation for cooling are naturally much worse off in this respect, and can use only a very low compression.

It will, of course, be understood that this prolongation of the combustion can easily be carried too far, and that it should in every case be completed well before the end of the stroke. The speed of the piston is here an important consideration. With motors running 1,000 revolutions per minute and over, a compression is allowable and even necessary which would be out of the question in launch motors plodding along at half that speed. The charge takes an appreciable time to burn; and the problem will often be how to make it burn fast enough to suit our ideas of rotation-speed, rather than how to keep it down to a speed made needlessly slow by clumsy design. With the requisite speed of combustion assured by proper vaporizers, a suitable compression, and early ignition, that engine will be the most efficient which expands its charge in the briefest possible time. Much energy has been wasted in attempting high speed with engines of faulty design and without due provision for the combustion; but all the signs point to a steady progress in that direction when the way is once made clear.

Electric Igniter for Steam Vehicles.

We herewith illustrate the electric device for igniting burners in furnace of steam vehicles, which has lately been described in our columns. Figs. 1 and 2 represent, respectively, the rear and side view of a Locomobile, with the igniting device attached in place; parts of the framework in either case being shown broken away, so as to more clearly represent the position and relative size of the attachment. Fig. 3 is a diagrammatic view of the entire apparatus employed. In this latter view, the spark-producing device is lettered "Igniter," which contains the electromagnetic vibrator which operates the sparking contacts at the upper end of the tube which surmounts it. The sparking tube passes through one of the air pipes in the furnace as indicated by the dotted lines. A. B. C. represents the iron brace, which supports rigidly the igniter in place, and is secured to the under side of the body of the wagon by screws B C. Dotted lines show the electric wiring circuit, connecting the igniter, push botton and battery, which latter is contained in a cylindrical case of neat design, as shown.

We are informed that no technical knowledge is required in the installation of the apparatus, so that any vehicle owner can attach it himself, without sending to the manufacturers.

As we have before stated, this device is put on the market by the A. L. Bogart Co., of New York City.

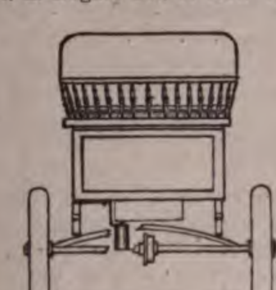


FIG. 1.

FIG 2.

Automobile Night with the N. Y. Electrical Society.

The 204th meeting of the New York Electrical Society at the College of the City of New York last Thursday was devoted to talks on the leading systems of horseless vehicle propulsion, by men prominently connected therewith. A. L. Riker spoke of the electric vehicle, C. J. Field of the gasoline and J. A. Kingman of the steam vehicle, respectively.

Mr. Riker began by mentioning the advantages of the electric system—its simplicity of control, smooth and noiseless running and the absence of speed change gears, due to the fact that the series-wound motor exerts its maximum torque at its lowest speed. Stereopticon views followed, which included circuit diagrams showing the method of connecting the four trays of cells in series or in multiple for different speeds, detail views of the battery trays, controller and lever, steering gear and frame, motor, current indicators, etc., together with views of several vehicles complete, from pleasure carriages to a heavy truck. The views shown were confined to the Riker system, and especial reference was made to the method of putting the differentials and steering pivots inside the wheel hubs, which is peculiar to this system. Both single and double motor drives were shown, the latter being declared preferable for heavy work.

Mr. Field prefaced his remarks by pointing out that while the electric vehicle had an undoubted field for city use, yet the limited radius of its battery action unfitted it for touring and general purposes, which could only be met by the prime movers, steam and gasoline. A representative air-cooled motor was then thrown on the screen, with the comment that this method of cooling had not been found practicable in powers about 2½ h.p. in one cylinder. A French design of water cooler was shown, with which it was said that three or four gallons of water would last a full day, or even more. A circuit diagram for jump spark ignition followed, with the remark, amid laughter, that 90 per cent. of the troubles with these motors could be traced to "poor electrical engineering" in providing a suitable spark.

A De Dion carburetter and an Abeille vaporizer were illustrated, the former being pronounced unsatisfactory on rough roads, where the jolting disturbed the float and consequently the mixture. The latter was described in The Horseless Age for Jan. 10, 1900, and the De Dion carburetter in the Explosive Motor Number. The method of direct injection of the fuel into the cylinder was mentioned by Mr. Field, but not favored.

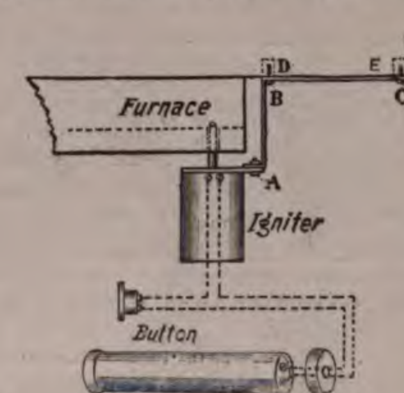


FIG 3.

A reference to the limitations of hot tubes was followed by several views of running gears and of completed vehicles, foreign types being chosen for the most part. The now decreasing practice of throwing the speed gears in and out of mesh at the teeth was severely condemned; and the hope was expressed that the development of business wagons in this country would result in much less unsightly productions than are in vogue on the other side of the water.

Mr. Field concluded his paper with the remark—which the audience seemed to find significant—that Mr. Riker intended to use a gasoline carriage in the coming Gordon Bennett international race.

Mr. Kingman's paper was largely historical and devoted to showing that heavy steam vehicles had been built and operated with more or less success as early as the thirties. The failure to press their development and use at that time he ascribed to the generally bad roads, public opposition and the diversion of interest to railroading, which was then just coming to the front.

Views of the various French steam tricycles, English and Continental steam trucks and light American carriages followed, and the series ended with views in detail of the boiler, burner and running gear of the Locomobile.

The discussion which followed disclosed some skepticism on the members' part regarding the low operative expense claimed for electric vehicles. One member pointed to the short life of the necessarily light batteries; and another, who confessed that he would rather sit over a tray of batteries than over a boiler, yet observed that if a set of tires cost $200 and was good for 200 miles, it was not difficult to compute the cost of running in tire miles. He suggested that Mr. Riker could give valuable information on that and the preceding point; but unfortunately Mr. Riker did not respond.

After a vote of thanks to the speakers of the evening the meeting adjourned.

Lead Cab Lecture.

Hiram Percy Maxim, Lead Cab engineer, delivered a lecture last Thursday before the Knickerbocker Athletic Club. He endeavored to show the general advantages and disadvantages of the different systems of propulsion, but omitted to discuss the subject of the maintenance of storage batteries. He expressed the opinion that the greatest progress would be made in electric vehicles. Harold Eames, another Lead Cab engineer, who was advertised to speak, was unable to appear.

James B. Stetson, president of the California St. Cable Railroad Co., of San Francisco, Cal., is looking for a suitable motor 'bus system to introduce between the terminus of the railroad at California St. and the ferry, a distance of 1,100 ft. over level road. He wishes to buy the motor trucks complete and have the bodies built in San Francisco.

LONDON NOTES.

London, March 15, 1900.

MOTOR VANS FOR CHELSEA VESTRY.

The Vestry of Chelsea has for some time past been considering the question of adopting motor wagons, and their surveyor has devoted considerable attention to the matter, a lengthy report of his as to the cost of working of the various types of heavy steam vehicles at present on the market having been forwarded to you in one of my recent letters. It is announced this week that the Vestry has accepted the offer of the Lancashire Steam Motor Co. for two vans with coke-fired boilers at £475 each. The annual cost of these vehicles is estimated at £293 18s. each, made up as follows: 15 per cent. depreciation, £73 10s; repairs, £55; fuel, etc., £75 8s., and wages of driver, £90. At the same time the Vestry has purchased a second-hand steam vehicle with two interchangeable bodies—one a tip wagon and the other a street watering cart—from the Thornycroft Steam Wagon Co., for the sum of £550.

THE AUTOMOBILE OF TO-DAY IN EUROPE AND AMERICA.

This was the title of a paper read at a meeting of the Automobile Club in London last night by H. Sturmey. The paper was a lengthy one and briefly reviewed the progress made with steam, electric and gasoline vehicles in both continents. In concluding the author remarked that, broadly speaking, while America undoubtedly leads in the electric vehicle and at present also in the light steam carriage, England is positively in front, and a long way in front, in connection with steam wagons for the conveyance of heavy goods, and is making good headway with petroleum vehicles, while France in the latter class of carriage undoubtedly leads the world. "I think, however, I can safely say that before five years are out England and America will be in the lead. I think it most probable that in steam carriages of all classes the English makers will eventually be in front, while in petroleum vehicles they will at least equal the French, and America will probably retain its lead in electric matters."

In the course of his paper Mr. Sturmey gave some particulars of a new steam carriage in the construction of which he is at present engaged, in conjunction with Makins, Ltd., of Manchester. This carriage will embody several new features. In the first place, it will obtain steam from a boiler invented by J. G. A. Kitchin, of Manchester; it is on the same principle as that of Serpollet, though weighing but 40 lbs., the water and oil tanks, boiler, and condensers all being arranged in front of the dashboard, so that no one will sit over the boiler, as in the case with other steam carriages. In the boiler and condensers the system of the cone which provides the greatest amount of effective atmospheric surface is used. The engine, too, possesses several new features. It consists of three high pressure cylinders 2¼-in. bore by 4-in. stroke, with a rotary slide valve and a crank shaft set at 120 degrees and the engine which, it is anticipated, when forced, will develop 10 h. p., weighs but 82 lbs.

IS IT A PENNINGTON?

The other day the following curious advertisement appeared in one of the daily newspapers:

"Notice is hereby given that at the expiration of one month after the 10th instant the undersigned will proceed to sell by public auction a motor car, made by the Rothwell Eclipse Machine Co. (Ltd.), Oldham, and left at my inn in the month of July last, and which has since remained unclaimed, the person

who deposited the same not having left his name, but which motor car is believed to belong to the said Rothwell Eclipse Machine Co. (Ltd.), or their consignee. Joseph Cooper, Queen's Head Inn, Wilnecote, near Tamworth, Warwickshire."

So far as I am aware, the only motor carriages built by the Rothwell Co. were to the order of the Pennington Co. The question naturally arises as to why it has been allowed to lie forgotten in a Warwickshire village.

It is reported that the German and French Automobile clubs are conferring as to a projected race between the French and German capitals next year.

The two company construction schemes referred to in my last letter, viz., that of the London Motor & Wagon Co. and the Motor Mfg. Co., have been ratified by meetings of shareholders this week. Some opposition was at first experienced to the directors' proposals in the case of the first named concern.

PLEASURE TOURS FOR THE PUBLIC.

According to a Birmingham newspaper, a successful trial was made on Monday last of one of the several gasoline motor cars which the Motor Car Excursions Co. are about to run from Birmingham on long and short excursions during the spring and summer months. The cars are of a new pattern and of two sizes—carrying 8 or 16 passengers. The scheme of the Motor Car Excursions Co. is of a manifold and ambitious character. All that its patrons have to do is to take a ticket, and they may even pay for that by installments, step on board a car in Corporation St., Birmingham, and be whirled off to Scotland, to Devonshire, to the Isle of Man, to Paris, all over Wales, or to any of a score of districts nearer home, fed and housed for a week or more, and dropped safely in Birmingham at the end of the itinerary. In fact, the company sets out as a sort of Motor-Cooks, taking entire charge of the holiday arrangements. The short excursions include all the places of interest and general resort within a radius of 25 miles of Birmingham. The trial trip on Monday last was to Stonebridge and back, and a very successful run was made.

THE LONDON LEAD CABS.

It is announced that the electric charging station of the London Electrical Cab Co., Ltd., together with the machinery, plant, licenses, cabs and premises in Lambeth, are to be put up for sale by tender. I did hear some time ago that the Morris & Salom people, of New York, were in treaty for the whole plant, and another rumor was to the effect that the cabs had been purchased for shipment to Paris, where they were to be used during the Exposition. Judging from the above announcement both schemes must have fallen through.

THE LINON GASOLINE VOITURETTE.

MINOR MENTION.

On Mch. 17, 80 persons had been licensed to drive automobiles in Chicago, Ill.

Beardsley & Hubbs, carriage builders, Massillon, O., are building an experimental motor carriage.

The Duryea Power Co., Reading Pa., have leased a portion of the Reading Cycle Co.'s plant.

T. L. Regester, formerly foreman in the Rock Island (Ill.) Plow Co.'s factory, is building a gasoline carriage.

The Lunkenheimer Co. have designed a special lubricator for Locomobile engines.

The St. Louis Motor Carriage Co. has opened an Eastern branch at 610 Drexel Building, Philadelphia, Pa.

The Overman Wheel Co., Chicopee Falls, Mass., are reported negotiating for the sale of all steam vehicle parts and material on hand.

Miss Julie E. Bracken, secretary of the Woods Co., enjoys the distinction of being the first woman legally licensed to drive an automobile in Chicago.

The directors of the Electric Vehicle Co. have declared a 2 per cent. dividend on the $5,000,000 preferred stock of the company.

The Conrad Motor Carriage Co. has been incorporated at Buffalo, N. Y., with $25,000 capital, by Julius H. Potter, Frank P. Conrad and David W. Adams.

A London insurance company is issuing a special personal and property accident policy for persons who are to take part in the 1,000-mile run.

Schaffer & Budenberg, Brooklyn, N. Y., have entered the steam vehicle trade and are now furnishing small pressure gauges for light carriages.

The legislature of New York State has appropriated $150,000 for road improvements, instead of the $1,000,000 which the Automobile Club asked for.

Lieut. I. N. Lewis, secretary of the Board of Ordnance and Fortifications, Washington, D. C., has obtained patents on an oil motor for vehicles, of which much is expected.

The Walden Ridge Automobile Co. has been formed at Chattanooga, Tenn., with $5,000 capital to run motor carriages out to Walden Ridge, a suburb.

The Anglo-American Rapid Vehicle Co. have secured the Barnes bicycle plant, Syracuse, N. Y., and are putting in machinery to manufacture automobiles. E. C. Stearns, of that city, is second vice-president and manager.

The Construction Liegeoise d'Automobiles, licensees under the Duryea patents, have completed their first carriages, which weigh 850 lbs. and have the main mechanical features of the well-known 1898 model of the Duryea Motor Wagon Co.

William A. Schaum, Thomas Philbin, William H. Wickham, Walter S. Lentbecker and John J. Carroll have organized the Schaum Automobile & Motor Mfg. Co., of Baltimore, Md., with $50,000 capital.

The Slaymaker-Barry Co., well-known lock manufacturers, South Connellsville, Pa., have purchased the rights of the Baldwin steam carriage, invented by L. F. N. Baldwin, Providence, R. I., and will manufacture it.

Kenneth A. Skinner, exclusive agent for the De Dion & Bouton motors in the United States, has secured the services of C. S. Henshaw and Oscar Hedstrom as racing experts to represent him on the track.

Alfred Harmsworth, the London publisher, who has been touring in France, states that in one day he counted 177 motor carriages and voiturettes and 269 tricycles on the roads of the Riviera.

The Union Automobile Co., recently incorporated in Maryland with $50,000 capital, is empowered to increase its capital to $500,000, to use any of the motive powers and to operate in any county or city of the State. The incorporators are George Waters, Spencer C. Watkins, Le Page Cronmiller, Louis C. Barley and Julian O. Ellinger.

The first road test of the racing machine which Alexander Winton is to take to France to compete for the Gordon Bennett Cup was made at Cleveland last Saturday. It is long and low in build, has the customary sloping wind cutter in front and is provided with a single cylinder motor of the same construction as usual, but of higher power. It will be shipped

The Maltby Automobile & Motor Co., of New York, has been incorporated, with $1,000,000 capital stock, by C. C. Hoge, C. A. Mackenzie, P. R. Brooks, F. D. Maltby and E. L. Maltby. F. D. Maltby has been doing business as the Maltby Automobile Co. at 10 Clinton St., Brooklyn.

The affairs of the General Electric Automobile Co. are to be readjusted. A committee composed of G. M. Dodge and Geo. Tracy Rogers, of New York, and J. S. Arndt, J. M. Butler and Thos. Earle White, of Philadelphia, has been appointed to formulate a plan either by a consolidation with some other company or by providing additional working capital.

The new and improved automatic injectors made by Wm. Sellers & Co., of Philadelphia, and sold by Jenkins Bros., have been designed for use in all places where a high class moderate priced injector is required. They restart instantly after a temporary interruption of the steam or water supply. All parts are made to gauge and can be renewed at trifling cost.

Makers of all sorts of supplies are now looking motorward. Motor vehicles require a fine grade of oil, so that progressive manufacturer of oils Wm. F. Nye, New Bedford, Mass., has brought out a brand of "Crystal Sperm Oil," specially refined for this purpose. It is colorless, stainless and odorless and may be used on all parts of a vehicle, including the motor, transmission and axles.

COMMUNICATIONS.

Facts and Kinks.

Buffalo, N. Y., March 21.

Editor Horseless Age:

I have tried the following methods of making gas for the carriage motor: Drawing warm air direct through the supply tank, adding more air through the mixer valve to form the explosive gas, warming the supply tank by means of a pipe from the exhaust muffler, and regulating the heat by a valve, the suction pipe being provided with an effective fire stop of wire cloth (eight thicknesses used) and a relief valve, as safety precautions. This arrangement has proved most satisfactory, although there are a few disadvantages, which I will describe later on.

Another plan involved the use of a carbureter in which the level of the gasoline was maintained by a float which operated a valve, the supply being gravity-fed from a tank at a higher level. This gave fair results when in good order, but required attention to insure a proper level, and the vibration of the carriage caused it to splash gasoline into the inlet, which made trouble at once. I tried two other carbureters, built on somewhat similar plans, with more or less success. All proved troublesome, and kept me guessing what the matter might be.

A vaporizer or mixer was interesting. It supplied a measured quantity of gasoline for each piston stroke, which was sprayed into the mixing chamber by the incoming air current. A needle valve controlled the liquid. An air valve fixed the amount of air, and my attention was almost constantly required to keep the two adjusted to suit the present conditions and I gave it up finally as too fussy. I could run the carriage with it, but was glad to get rid of my troubles and go back to the simple single supply tank, placed below the motor level and as far from the sources of fire as possible.

Long use has made me feel safe with this plan. I draw no liquid from it. A leak does not spread the dangerous stuff over the carriage and motor; the electric wires are not near it. In fact the danger is reduced to the handling of the gasoline in filling.

I find one disadvantage in the fact that after standing a long time in the barn the supply in the tank deteriorates, and I am not able to start up promptly, but the addition of a quart or so of fresh gasoline will remove the difficulty.

Another trouble is in filling the tank too full. It must not be more than two-thirds filled, or the splash will bother at times.

The gasoline can be used down to within ½ in. of the bottom. The gas grows poorer, however, as it gets low, and I try to renew often when convenient.

The combustion seems more perfect with this plan than either of the others, as evinced by less odor in the exhaust, and no smoke in the cylinder. I suspect, however, that the power developed may not equal that produced by a liquid feed or spray mixer. Am I correct? However, comfortable riding is the end aimed at.

An oil cup on each cylinder supplies the pistons; the surplus drops into the crank box and is splashed and blown over all the other moving parts. My only care is to keep those cups in working order and supplied with oil.

Occasionally it does good to put a little kerosene oil in the cups to clean out the old oil from the pistons and their rings. Gasoline answers the same purpose but is more risky to handle.

When using the jump spark the surplus oil used to cause trouble by burning on the points and stopping the ignition, but with the present wipe spark it really improves it.

Dry graphite is interesting, and I hope to try it soon. While using the jump spark I made a failure of it on account of the coating of the insulation inside the cylinder and the covering over of the points.

The carriage, being fitted with ball bearings all over, requires little or no oil. I do not remember using the oil can more than once during the summer.

Twelve hundred miles of road driving has developed one puncture in one front tire. This was mended by "jiffy" in a few moments, and the repair remains good.

Twice only have the tires been pumped up. They are somewhat slack now and need air.

Once a rear wheel came off in the dark 8 miles from home. A plank under the axle wired to the step made a slide that enabled the motor to drag the wreck slowly home. That wheel was found next morning in the bush by the roadside, far from the spot where the accident occurred, for we were going at top speed at the time and were crossing a trolley track.

A broken connecting rod disabled one cylinder upon another occasion and developed a scheme to mote with the other one. It was successful, though slow, showing the advantage of two cylinders.

A small storage battery provides current for ignition. It lasts from 12 to 15 days, but is recharged every three or four days while standing in the barn by connecting with a primary battery placed on a convenient shelf, a proper resistance being placed in the circuit to prevent too rapid charging.

Thus the storage is usually full charged, and gives a good spark, and would carry current for a long trip.

The article by Mr. Nungesser on ignition sets me thinking that my 10-in. coil may not be the best, and I want to learn where to get a better one.

E. N. B.

[Our correspondent's experience is interesting as tending to controvert the views usually held as to the relative merits of tank and jet vaporization. It will be seen that the vertical oscillation of a float, due to its not following promptly the jolting of the carriage, might readily become a serious difficulty on any but good roads. Evidently the heavier the float and the greater its freedom of movement with respect to the valve, the more marked this effect will be; and it would seem a not impossible task to devise a "dead beat" float, which should respond only to changes in the gasoline level.

The grade of gasoline used will have much to do with the success of a tank carbureter, since with any but the lightest spirit the more volatile portion will evaporate first and the heavier remainder will need either more heat or more time, or both. The best plan is to use abundant evaporating surface to insure saturation under all conditions. Perhaps E. N. B. would tell us what grade of gasoline he uses.—Ed.]

A Nudge for the Automobile Club.

St. Louis, March 22.

Editor Horseless Age:

Your readers no doubt remember me as the man who is being prosecuted under an indictment by the Grand Jury for

felonious assault, all because my automobile happened to frighten a fractious horse and overturn a buggy. You have already published all the details of the affair.

Notwithstanding all the notoriety which has been given this case in the automobile press, I have received no offer of assistance, either moral or financial, from the Automobile Club of America. Are they asleep? At the time of the accident I promptly mailed full description of the case to the official of said club, but have never heard a word from him, although almost two months have elapsed. Does not the club know that I might easily enter the plea of guilty and escape with small fine; but yet the court's decision would be a lasting blight upon the entire automobile industry? Of course I would not be such a knave as to stoop to such a proceeding, but I merely mention what might possibly occur.

How would the officers of the club like it should this case turn out adversely to the automobile? How would they like to be prohibited from using their automobiles on the streets, and all because of lack of interest in this case?

The latest news in regard to the case is that I filed a demurrer to the indictment, but the demurrer was overruled and the case continued until May term.

It seems to me that if this were a bicycle case, in which the rider of a bicycle was being prosecuted under an indictment simply for "scaring" a horse, the L. A. W. would long ago not only have offered assistance but the case would have been tried and either dismissed or appealed. If the Automobile Club can stand it I guess I can. Very truly yours,

JOHN C. HIGDON.

A Physician's Experience.

Plymouth, Pa., March 23.

Editor Horseless Age:

I have used a steam carriage in my professional and official work, also an explosive motor carriage, for about six months. From my personal experience I am led to conclude that for a physician an explosive motor carriage is exactly what is required. A busy physician, thinking and worrying about Mr. A with pneumonia, or Willie B with appendicitis, or Miss D with a pus cavity in her lungs, has no time or inclination to think whether or not there is water in the tank of a steam carriage or to pump up 30 or 40 lbs. of air in the air tank. And when he is making a rather long call it is rather annoying to hear the safety valve on his steam wagon go blowing away like a locomotive, to the terror and consternation of pedestrians and horses. When these little annoyances can be done away with, then I might possibly go back to a steam wagon; but until then I am a firm convert to the explosive motor carriage. All I have to do now is to go to my carriage house (which is heated by steam, and all purchasers or prospective purchasers of motor wagons should know that all carriages must be kept in warm storage during the winter), turn on the gasoline, start the motor, jump in the carriage and go about my business, stopping to make professional calls, all the forenoon, with no pumping, no water tank, no fire, no blowing off of 220 lbs. of steam, no frightened horses. If one makes a very long call it's quite easy to turn off the fuel and start and be off in three-quarters of a minute, as I have done a great number of times.

I have put my explosive motor carriage through the streets and roads when the mud was half way up to the hubs, and over frozen, rutty roads that would have taxed a horse vehicle very severely. I tried to do the same with a steam carriage, but found it too light. It would skid or slip about in a most discouraging manner. Any motor wagon to be practical on muddy roads should be heavy enough to sink to solid ground, thereby insuring proper traction.

I would add that the cost of fuel is very much on the side of the explosive motor carriage

FRANK L. McKEE, M.D.

Vaporizer or Carbureter?

Pomfret Center, Conn., March 20.

Editor Horseless Age:

Will you please let me know if I could use a vaporizer in place of a carbureter on a motor tricycle, and if heating the air before it enters the vaporizer would overheat the motor?

ALFRED WAGSTAFF.

1. For general use a vaporizer is preferable to a carbureter, but it should always be used in connection with an overflow cup or float tank, so as to draw the gasoline from a constant level.

2. The motor will not overheat, but the air should not be warmed more than enough to vaporize the gasoline, which is very little.

METROPOLITAN ITEMS.

H. P. De Gowan, 23 Warren St., is exhibiting the Overman steam carriage.

Osterberg & Sutton, consulting engineers, 11 Broadway, are constructing an electric carriage.

The Lion Acetylene Gas Generator Co., 568 West Broadway, have applied for patents on an explosive motor.

T. Shriver & Co., 331 East Fifty-sixth St., are building a gas engine, the chief feature of which is the form of cylinder used.

Mr. Bunce, of the Storage Battery Supply Co., claims that a battery of his make lasted for a 2,800-mile run before it gave out.

The Diamond Rubber Co. have been compelled to increase facilities at their repair shop, 215 West Fifty-third St., in charge of W. W. Whiting.

Morrocoline, made by the Boston Artificial Leather Co., 12 East Eighteenth St., is recommended for motor vehicles because it is not injuriously affected by rain, sun, heat, cold, dust or stains.

The long-wished-for burner for steam vehicles is said to have been perfected by the Primus Co., 197 Fulton St., the well-known makers of the kerosene cooking stoves of the above name. The burner is called "The Royal Blue."

The Turner Mfg. Co., 245 Broadway, are introducing their patent Anti-Friction Roller Bearing Fifth Wheels to the motor vehicle trade. These are made of angle steel and are provided with steel rollers revolving around steel spindles riveted between steel frames. They are said to require no grease or oil.

OUR FOREIGN EXCHANGES.

The Renaux Tricycle.

A distinct novelty in French tricycles is one lately invented by M. Prosper Renaux, of which the following description is condensed from La France Automobile:

Instead of being vertical, the motor is placed horizontally and lengthwise of the machine. The usual rear bridge, or horizontal transverse member over the axle, is replaced by two sleeves, E' (Fig. 2), one on each side of the crank case, with the axles revolving within them. These sleeves contain ball bearings at their inner and outer ends, and their inner ends terminate in bell-shaped covers, C (Fig. 2), which are threaded into the rims of gear cases cast on the outside of the crank case. The wheel axles are independent, and are driven by pinions, P (Fig. 4), which engage internal gears on the axles and inside the cases just mentioned. In addition, the left-hand gear case contains the secondary gear F (Fig. 4) for operating the igniter and exhaust valve. This is independent of the driving gears and will be referred to later on.

The differential is made a part of the motor itself and is clearly shown in Fig. 5. The disk cranks V, which serve also as fly wheels, are connected by the enlarged crank-pin M, which turns in the roller bearing r r and is located with reference to the cranks by the pins b b. This crank-pin contains the differential pinion S, and through it drives the bevel gears D, which are keyed to the shafts of the driving pinions P (Fig. 4).

The cranks V are not connected to the bevel gears D, but are riveted to flanges, A (Fig. 6), at the inner ends of short

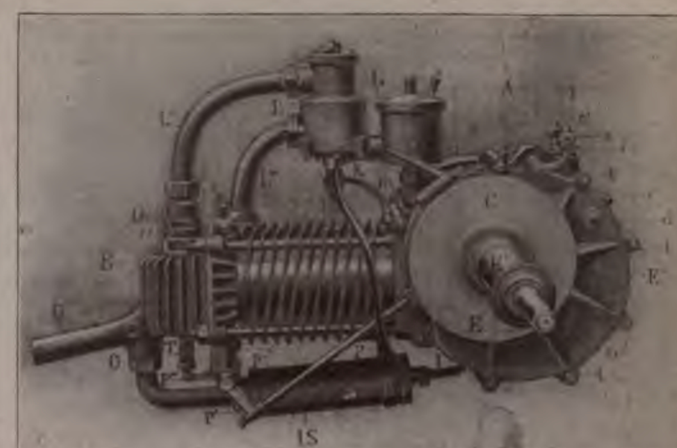
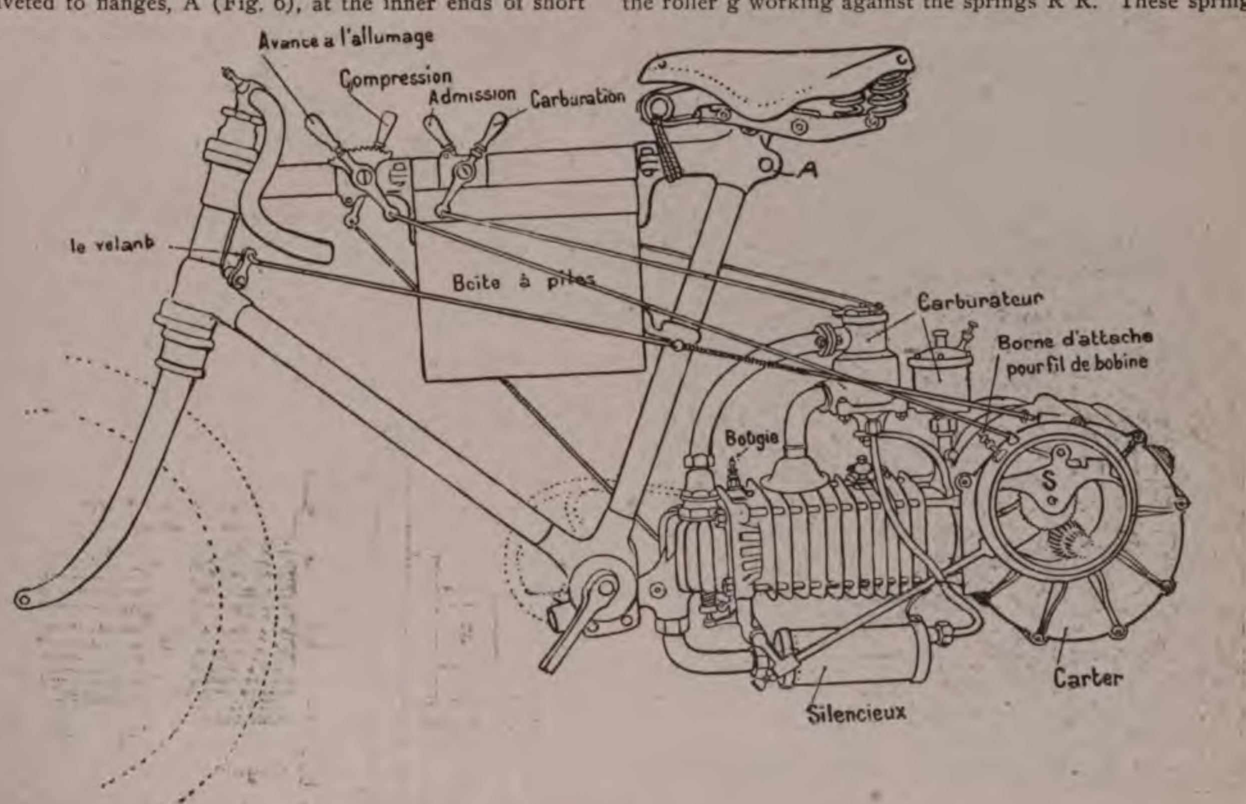


FIG. 2. MOTOR AND CARBURETER.

sleeves, which inclose the pinion shafts G and themselves revolve in the roller bearings L. That on the left-hand side has on its outer end a pinion to drive the ignition gear (shown also at C, Fig. 4); but on the right-hand side, as we understand it, the motor pinion is close to the roller bearing. It will be seen that by this arrangement, while the cranks revolve uniformly, the pinion shafts are free to conform to the relative motion of the wheels.

The gear F (Fig. 4) has on its reverse side a cam which rubs against the slide p, and this lifts the exhaust valve through the push rod and bell crank shown in Figs. 2 and 3. The igniter is of the jump spark type, with single make and break, and the primary circuit is closed at M (Fig. 4) through the roller g working against the springs R R. These springs



THE RENAUX MOTOR TRICYCLE.

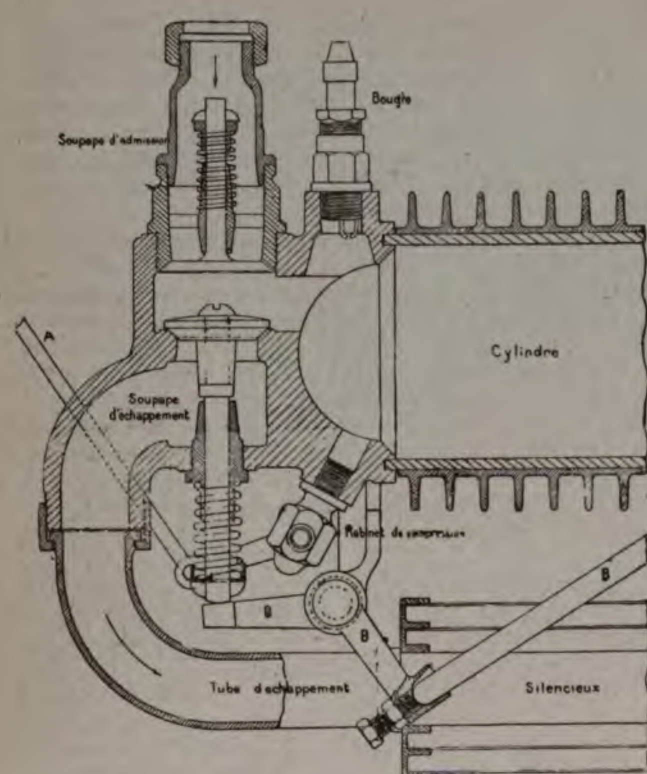


FIG. 3.

are mounted on an insulating block, S, which together with the gear F is centered by the stud A; and lead is effected by advancing S by means of the slotted slide m, which engages the pin V.

The valves, ignition plug and relief cock are clearly shown in Fig. 3. This shows also the ribbed jacket, which is of bronze and is shrunk on to the cast iron cylinder. The cylinder head is malleable iron, with a tube Q (Fig. 2) brazed to it, by means of which the motor is made to serve as part

IGNITION MECHANISM. FIG. 4.

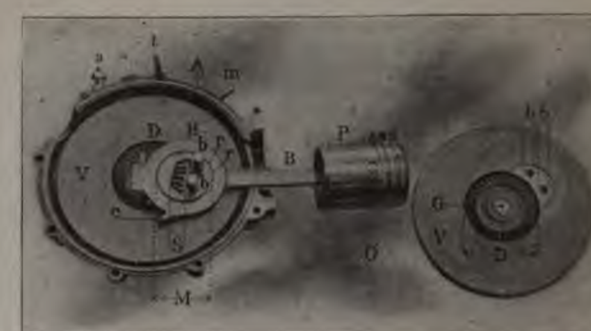


FIG. 5. DIFFERENTIAL.

of the rear frame. The pedal cranks are arranged to start or assist the motor through a ratchet and sprocket chain, and the motor can be adjusted fore and aft to tighten the chain. The usual struts connect A (Fig. 1) with the outer ends of the sleeves E', and we presume that these are articulated to permit of the chain adjustment aforesaid.

The carbureter is of the latest Longuemare type. The gasoline is contained in the cup L. The air drawn up the pipe L''' is warmed by the heat of the motor, and the mixture passes down L'' to the inlet valve. The tube l supplies additional heat from the exhaust gases to evaporate the gasoline. There are two brakes, one a band brake on the left fly-wheel, controlled by a lever on the handle bar; the other a double brake, on two drums on the rear wheel hubs. The latter is not shown in the illustration.

As there is no rear bridge, it is only necessary, if one wishes to get at the igniter contacts, to slacken the left strut where it is clamped to the sleeve E' (Fig. 2). The cover C can then be unscrewed and cover, internal gear, axle and wheel may be drawn out laterally as far as the length of the sleeve E' permits. The exhaust valve can be got at by unscrewing the inlet valve seat; and aside from these there should seldom be occasion to get at the interior of the motor.

The motor is 90 by 90 mm. stroke dimensions (3.54 in.) and is said to brake 3.7 h.p. at 1,400 revolutions per minute.

English terms to be substituted for the French in engravings of Renaux tricycle:

Figure 1.

Avance à l'allumage—Ignition lead.
Compression—Relief cock.
Admission—Admission.
Carburation—Carburation.
Frein sur le volant—Brake on fly wheel.
Boite à piles—Battery case.

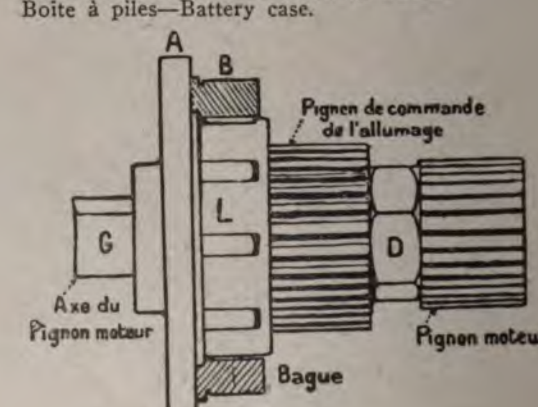


FIG. 6.

Carburateur—Carbureter.
Borne d'attache pour fil de bobine—Binding post to spark coil.
Bougie—Igniter plug.
Silencieux—Muffler.
Carter—Crank case.

Figure 2.

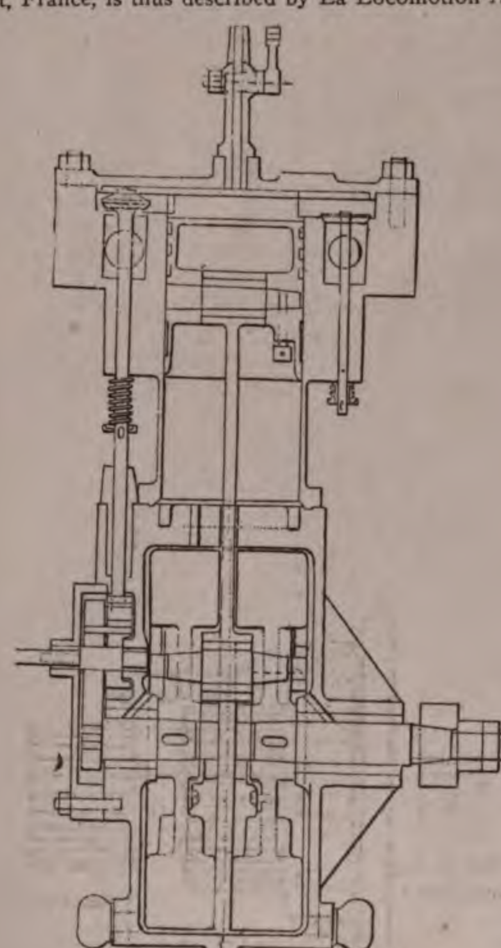
Soupape d'admission—Inlet valve.
Soupape d'échappement—Exhaust valve.
Bougie—Ignition plug.
Cylindre—Cylinder.
Robinet du compression—Relief cock.
Tube d'échappement—Exhaust tube.
Silencieux—Muffler.

Figure 6.

Axe du pignon moteur—Motor pinion shaft.
Pignon de commande de l'allumage—Pinion to drive ignition gear.
Pignon moteur—Motor pinion.
Bague—Fixed ring.

The Romain Motor.

The Romain motor, which is being used on the Delaugere tricycle, made by Delaugere & Co., 89 Rue d'Illiers, Orleans, Loiret, France, is thus described by La Locomotion Automobile: It is a vertical single-cylinder motor, provided with radial ribs and developing 2 h.p. at 1,300 revolutions. The cylinder has a diameter of 82 mm. and the stroke is 80 mm. The forged crank shaft runs in phosphor bronze bearings and acts upon a crank pin connecting two flat disks forming fly wheels, the axis of which is mounted in a case of partinium (the new aluminum alloy), containing oil for the constant lubrication of the moving parts.



THE ROMAIN MOTOR.

The admission valve is forged from a single piece of soft steel. The exhaust valve is cast and is mechanically operated. One of the axes of the fly wheel carries a pinion having 13 teeth and made of mild tempered steel, which engages with a second pinion having 26 teeth, the axis of which, supported by the frame at one end and by a socket at the other, is extended 20 mm. to accommodate the igniting mechanism. A cam of mild tempered steel is connected with the 26-tooth pinion by a pin. This acts on the inclined faces of a tempered poussoir, the tail piece of which operates the exhaust valve. The cam closes the valve exactly at the end of its course, the advance being one-ninth of the stroke of the piston.

Ignition is accomplished in the usual manner by a cam and a spring hammer, so that either an open or closed circuit high tension current may be used. The base is movable in a circular manner from 35 to 40 degs.

The speed of the motor is varied by means of the ignition. The seat of the valves is in the body of the cylinder directly under the lid, facilitating repair. The wall of the cylinder is reinforced by cross bars joining the two eccentrics and giving great rigidity, while permitting a lighter construction in the casting.

The Adams Motor.

We have received from the manufacturers, Adams & Co., Lowestoft, England, the accompanying drawings and description of a new motor for light carriages, which they are placing on the market. It will be noted that the cylinder head and valve box are unjacketed, this being facilitated by the use of a ground joint and by casting the head solid with the liner, so that the surplus heat is readily conducted away. A leather face is used on the exhaust valve lifter, which prevents the clicking which would otherwise be caused by the sharp lift of the eccentric. The light design of the piston, the use of a rawhide secondary gear, and the manner of fitting the water jacket are noticeable features. As the water jacket and not the liner is the member screwed to the crank case, it will be seen that the force of the explosion is sustained not only by these screws, but by the ⅜-in. screws E, a construction which might perhaps be criticised.

The motor is 4¼ by 4¼ in. stroke dimensions. The compression is unusually high, and its makers claim 3 b.h.p. for it.

The description, quoted from the Autocar, is as follows:

"The motor is connected to the car by two parallel strips of iron projecting beyond the valves and the fly wheel; they are bolted to the motor at A and B, Fig. 1. The water jacket is bored conical, as at C and C_1. The cylinder (liner D) is cast with its cover on and is turned to fit the jacket at C and C_1, being held in position by the four ⅜-in. screws E. This joint need never be broken, unless the cylinder requires reboring, or for clearing out deposits of scale or dirt in the

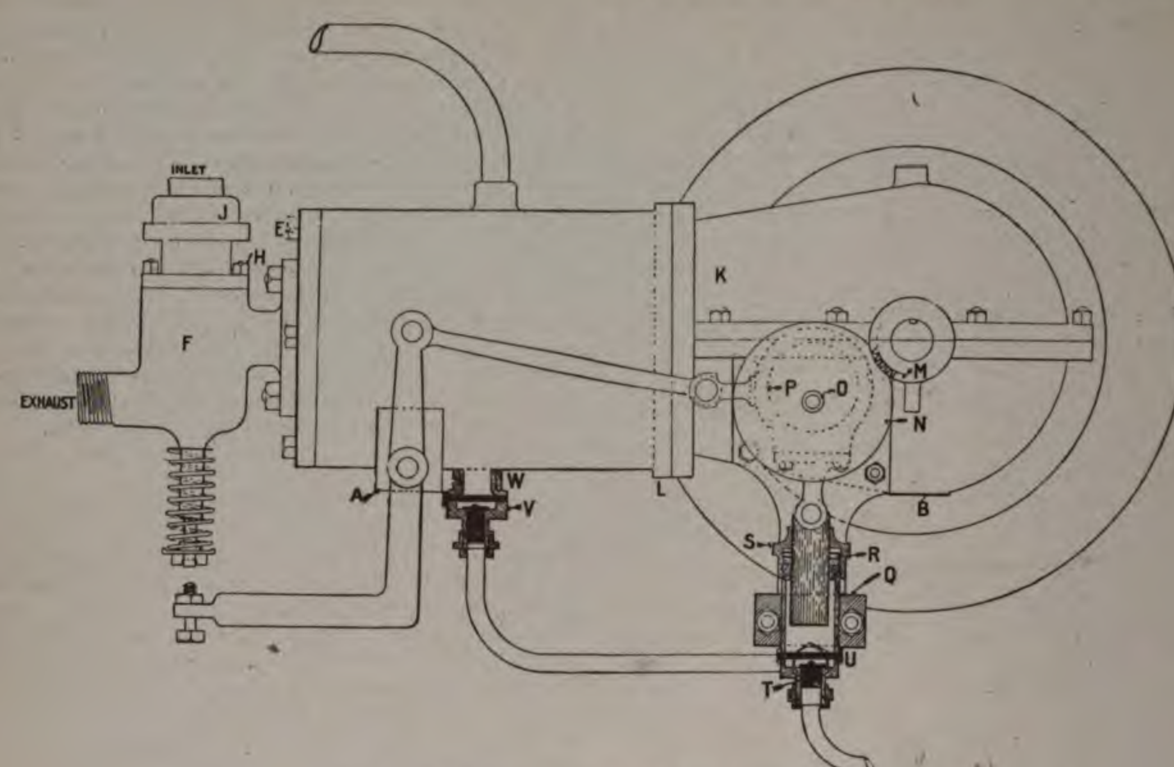


FIG. 1. ELEVATION OF $4\frac{1}{4}$ X $4\frac{1}{4}$ INCH ADAMS MOTOR.

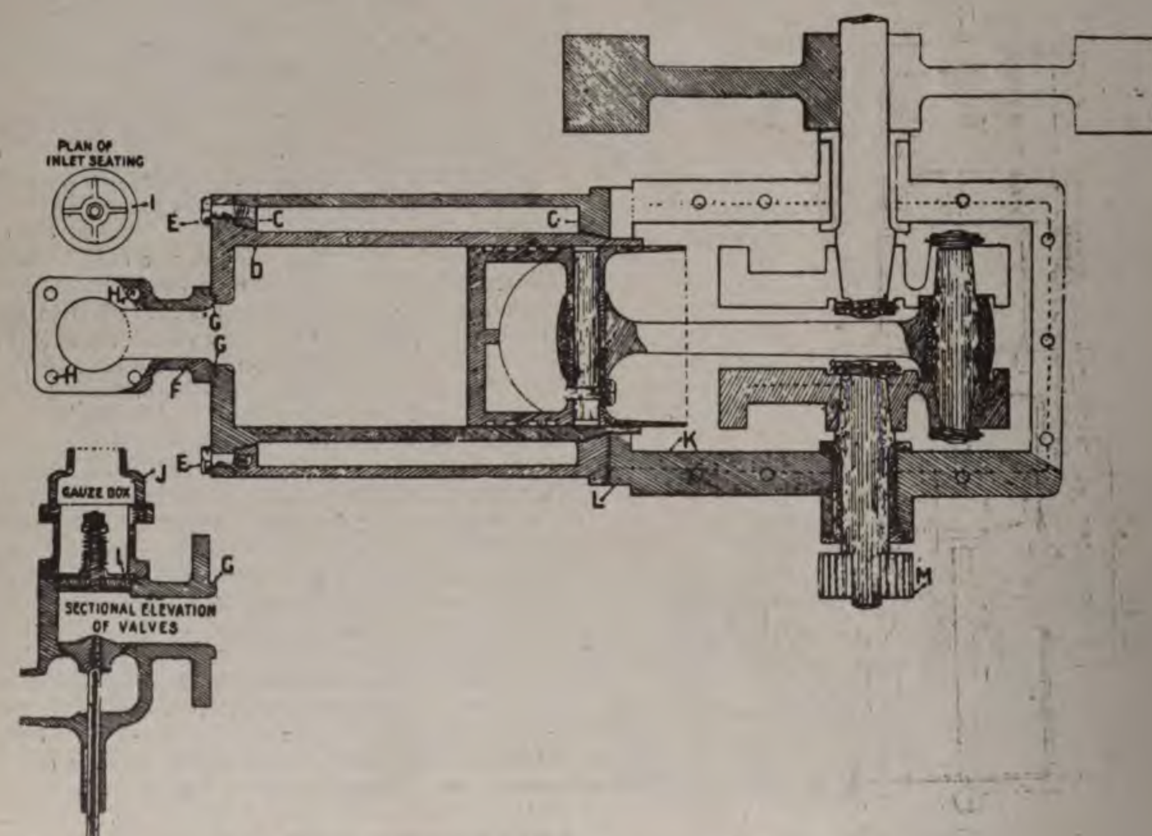


FIG. 2. PLAN OF ADAMS MOTOR AND SECTIONAL ELEVATION OF VALVES.

water jacket. The valve chambers F are bolted on to the cylinder cover, having a ground joint at G, Fig. 2. The valves are very easily removed, for by unscrewing the four nuts H the inlet valve and seating I can be lifted out. The gauze box J is directly over the top of inlet valve. A small portion of the cylinder projects through the water jacket and fits into the flange on end of oil-tight crank chamber K, being held in position by four ½-in. screws. The cranks are double disks of accurate balance. On one end of the crank shaft is a third bearing (Brown's ball), and on the other end is keyed a gun metal cut pinion, M, driving a Chicago rawhide wheel (1⅛ in. wide), N, mounted upon a long phosphor-bronze sleeve, O. On one side of the rawhide wheel is keyed an eccentric, P, which opens the exhaust valve and works the pump. On the other side of the wheel N is fixed the ebonite disk for the electric ignition. The gun metal pump Q is 1-in. bore by ¾-in. stroke, and runs half the speed of the engine; it is packed at R, and the packing is tightened occasionally by screwing down the gland S. The suction valve T is in the bottom of pump and the lift is adjusted by an eccentric screw, U. The clack box V is of the same form and screwed into the water jacket at W. The makers tell us they have never known these pumps to fail, after using them for pumping all classes of liquids. The speed is varied from 200 to 1,200 by advancing the firing of the electric ignition."

The Amedée Bollée Gasoline Delivery Wagon.

The accompanying illustration shows one of the several types of heavy gasoline delivery wagons built by De Dietrich & Co., of Luneville, France, on the Amedée Bollée system. The frame is built up of channel steel sections. The motor, which is of the horizontal two-cylinder type, with tube ignition and water jackets, is of 10-b.h.p. and is located on the fore part of the frame. Three speeds forward—2½, 5 and 9 miles an hour—as also a backward motion of 2 miles an hour, are provided. The power of the engine is transmitted by a single belt to a countershaft at the rear; this is geared by spur wheels, forming the variable speed gear, to a parallel intermediary shaft. At each end of the latter are bevel gears connected by short longitudinal shafts, like the chainless bicycle, to large bevel pinions bolted to the rear wheels. The driver is provided with a cab, while all the controlling levers are grouped near the steering wheel. Special attention has been devoted to the wheels, which are of the artillery type, shod with iron tires. The gasoline tank has a capacity for a run of about 100 miles, while 30 liters of water are carried, this being said to be sufficient for a day's run, there being two indicating coils provided, one at each side of the cab. The platform measures 5 ft. 2 in. by 8 ft. 2 in., while the over all dimensions of the vehicle are 6 ft. by 11 ft. 9 in. The wagon can, it is stated, carry a load of 2½ tons at a maximum speed of 9 miles an hour on level roads, and can ascend gradients of 1 in 8 on the low gear. Complete, with gasoline and water for a day's work, the wagon weighs about 4,000 lbs.

AMEDÉE BOLLÉE GASOLINE DELIVERY.

The "Auto Lyte."

Under this name A. H. Funke, 101 Duane St., New York, is bringing to the attention of motor carriage owners and the trade an acetylene gas lamp, which he claims is the first one of its kind put on the market, all other acetylene lamps offered for this purpose being merely carriage lamps and not adapted to swift-running automobiles, which need a strong light directly ahead, showing the road from 100 to 150 ft.

The lamp is simple in its adjustments and is self contained, no extra tank or generator being necessary. It is easily and securely fastened to the center of the dash, has no glass to break, is said to be unaffected by the strongest wind and makes its own gas at a cost of half a cent an hour, one charge of carbide lasting six hours. The diameter of the reflector is 7 in.

To Push the Motor Cycle Business.

One of the most important pieces of news in the motor trade during the past week is the announcement that the Waltham Mfg. Co., Waltham, Mass., have secured the exclusive agency in America for the Aster motor, made by the Aster Motor Co., of Paris, France, and in future they will fit their tandems, tricycles and quadricycles with either the De Dion or Aster motors, the two best known and most widely used motors of this type in the world.

The motor cycle has been very extensively used in France, but the American mind has turned to the motor carriage, and the Waltham Mfg. Co. was the first to build and market a motor cycle, and a number of their motor tandems which were marketed last spring and summer were used in paced races throughout the country. This winter they brought out and are now delivering tricycles and quadricycles. It has been generally conceded that their motor tandem is much more graceful in appearance than any that have been produced on the other side, and, as will be seen from the accompanying cut, the Orient quadricycle certainly presents a more elegant appearance than the pictures which we are accustomed to see of the French quadricycles.

While similar in most respects to the De Dion, the Aster presents a different appearance. The De Dion motor is cooled by flanges cast into the cylinder, while the Aster is cooled by corrugated copper flanges compressed around the cylinder head. The Aster Co. have a patent on their cooling device and claim that it is superior to the other, in that copper is a better conductor of heat, hence a better radiator than iron, and that on account of the corrugations the flanges have a great deal more cooling surface.

The Waltham Co. have christened their quadricycle "Autogo."

Modern Machine Shops.

The Berlin Iron Bridge Co., East Berlin, Conn., builders of steel bridges and "Modern Machine Shops" of steel, has increased its capital stock to $750,000 and made plans for the establishment of extensive branch works at Pittsburg, Pa., which are now being designed and built at the East Berlin shops. It is the intention of this enterprising concern to make the new plant the best in the country of its kind. Motor vehicle manufacturers who are putting up new factories or making additions to old ones should investigate the merits of steel shop construction as practiced by The Berlin Iron Bridge Co.

A Challenge from Mr. Skinner.

Kenneth A. Skinner, United States agent for De Dion & Bouton, offers to make a match with any person in the United States for a motor vehicle race over a distance of 50, 100 or more miles on the road or track. He will use his De Dion motor tricycle and will allow his competitor to use any machine, whether propelled by steam, electricity or any other power. He has deposited with the Boston Globe $50 for the match, to be increased to $500 if necessary, and will leave this deposit up for one month, and if it is not accepted by that time he will take no further notice of challenges. He will also agree to use only one motor on his tricycle, while allowing any of the imitators of the De Dion-Bouton motors manufactured in the United States to pit two of their motors against his one.

Parts and Supplies.

The Automobile Supply Co., St. Louis Mo., are making a light runabout with tubular reaches and single sprocket differential, which they state is adapted to any motive power.

The front axle proper is 1¼ in. and the swivel bearing of roller style and 1¼ in. The rear axle is 1¾ in., with short hollow shaft on one side passing through the roller bearings and keyed to the gear in the differential, the other gear in the differential being keyed to the axle. It is not cut, as is generally the case.

The reaches extend from the front to the rear bearings and are connected in such a way that the entire frame is flexible. Borbeins' patent spring block bearings are used and the springs are easily attached without the customary wood spring blocks. Springs are then placed two on the rear side and one across the front, or two in front and rear, as desired, and then an angular iron frame ready to receive the body.

They furnish heavier gears for dos a dos, traps, etc., drawings of bodies with dimensions, etc., for any style of rig, and motive power—electric, steam or gasoline—transmission devices, etc.

QUADRICYCLE OF THE WALTHAM MFG. CO.

MOTOR VEHICLE PATENTS of the world

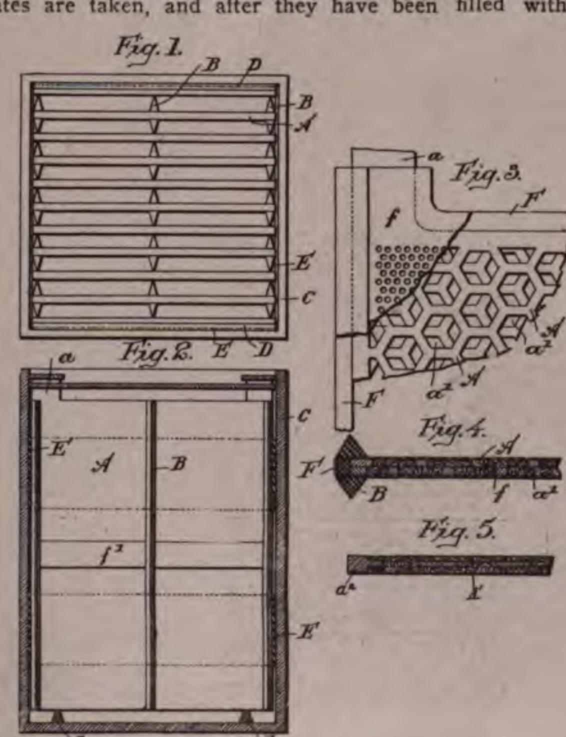
UNITED STATES PATENTS.

No. 645,478—Accumulator.—Henry Leitner, London, England, assignor to the Electrical Undertakings, Ltd., of same place. Application filed March 25, 1898.

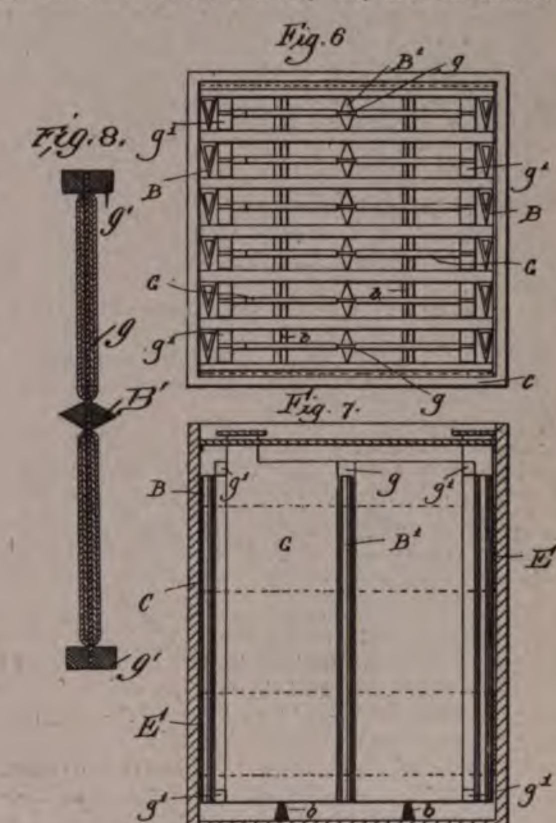
The main feature of the invention consists in the utilization in a peculiar manner of the pressure produced by the expansion of the peroxide plates, so as to insure that the parts be kept in proper position and to prevent the lead peroxide from dropping out of the plates, the arrangement also insuring a larger contact surface.

Fig. 1 is a plan of an accumulator constructed according to the invention. Fig. 2 is a vertical section of the same, taken between two of the plates. Figs. 3 and 4 are respectively an elevation and a cross section of grids for the peroxide plate. Fig. 5 shows a modified form of plate, and Figs. 6 and 7 are respectively a plan and a vertical section of the arrangement as applied to zinc accumulators. Fig. 8 is a detail view.

The peroxide plate is formed as follows: A double grid or frame, A, is used, consisting of two lead sheets of suitable proportions, provided with contact bars or extensions, a, at one side. Each of these plates is formed with a series of holes, a', which may be hexagonal in shape. These are stamped from the plate by conical dies, so that the sides of each hole are beveled. The hole is thus slightly larger at one side than at the other, as shown in Fig. 4. Two such plates are taken, and after they have been filled with the



paste or material from which the peroxide is to be formed they are placed face to face, so that the larger sides of the holes are at the inside. The plates are also arranged so that the holes do not register with each other, the bars of one plate crossing the holes of the other. Owing to the beveled form of the holes, the plugs of paste will not be liable to fall out, even without the pressure produced in the manner hereinafter described. As, however, the arrangement is claimed to prevent the peroxide falling from the plate without such construction, the form of plate shown in Fig. 5 may also be used. This consists of a single grid, A', perforated to receive the paste. The rim a^2 is thicker than the body of the plate and the paste fills up the plate to the level of the rim, as shown in the drawings. On both sides of the negative plate parallel pieces B of resilient material, such as celluloid, are fixed. These bars are not secured directly to the plate, but to the inclosing frame. Three of these bars are employed in plates of ordinary size; but a larger number may be used. These separating pieces, which are used to transmit the pressure and not merely as distance pieces, may be made of triangular shape in cross section, and they may also be hollow. This



form allows the sides of the pieces to bulge out on transverse pressure being applied to press the plates together. As the material is elastic, any compression which may occur will not permanently change the shape of the bars, but these will spring back again into their normal shape on the pressure being relieved. A series of plates are placed together, the faces of the positive plates resting against the separating rods or tubes of the negative, as shown clearly in Fig. 1. The plates when inserted in the case C rest on the supporting bars b, which may be of the same material as the separating bars. On both sides of the series or block of plates so formed a plate, D,

of impregnated wood or other suitable material is placed. This is preferably grooved at one, two, or more parts, and in the grooves bands, E, of the resilient insulating material, as celluloid, are tightly fitted. These bands are continuous and of considerable width to give the required strength and great resistance to a pulling force. When the arrangement is complete, a solid mass is formed, the plates being pressed closely together, separated only by the elastic tubes or bars.

The resilient casing inclosing the plate consists of a bar or rim, F, of the same material as the resilient bars, extending completely around the plate and covering part of the lug. On this rim the perforated sheets f, also of the said resilient material, are fixed, so that the plate is completely inclosed. The celluloid is not fixed to the lead plate at any point, but merely incloses it. The perforations of these sheets do not extend close to the edges, so that side strips of unperforated material are formed which cover the sides of the lead grids and protect them from the action of the electrolyte. These rims are shown of square cross section in Fig. 4; but any other suitable cross section may be employed. The bars B, which in the detail views are rectangular in cross section, are fixed at their ends only to the unperforated edges of the sheets f, the main part of these bars being quite clear of the perforated sheets. Any extension in length of plate will thus stretch the bars, which will return the plates to their proper shape when contraction of the peroxide occurs. A cross strip, f', may also be employed, fixed only at its ends and serving to take up any side expansions. As the conducting lug, as well as the sides of the grid, is protected by the frame from the solution, it will not be liable to get attacked. This arrangement of inclosing frame or case is employed only in connection with the negative plate. The positive plate may be left unprotected and simply supported by the side band and by side strips and small supporting pieces, which prevent the positive plates dropping or shifting with respect to the negative.

The material of the bands and bars should possess considerable strength and stretch very little for a large pull, so that the amount of expansion which occurs in the accumulator will cause a very powerful reaction, which presses the halves of the plates tightly together and therefore the plugs in the grids hard up against their conducting surfaces. When the peroxide in the plates expands, its tendency will be to cause the two sheets or perforated plates of lead of which each plate is built up to separate, this action taking place owing to the beveled form of the holes and the fact that the plates are placed back to back and are joined together at the edges only. Each plate will thus tend to bulge slightly out on both sides, so as to become thicker and to increase the width of the block of plates formed as above described. This expansion is resisted by the outer bands and the separating pieces, and as these are all resilient they will give slightly to the great pressure produced by the expansion. The expansion owing to this back pressure will thus cause the peroxide plugs to be pressed firmly against the lead grids, giving the largest possible conducting surface. As the peroxide contracts, instead of the pressure being at once taken off, as would be the case if the parts were not resilient, the extension or compression of these resilient parts is utilized to recompress the plates until they return to their former size. The plates are thus again pressed quite flat, and the active material in both plates is still kept tightly against the grid. The peculiar formation of the grids enables this action to take place, as the expansion does not tend so much to open the holes, and thus to be transmitted sidewise, but only slightly separates the two plates against the force of the binding material of the whole block. In the single plates the action is similar, with the exception that the peroxide is not inclosed between two grids, but only by the external casing. This arrangement also allows a large number of thin plates to be employed instead of a smaller number of thick ones, as in the present accumulators. A greater surface is thus provided, which substantially increases the efficiency of the accumulator. At the same time the block of plates formed in the manner described is quite solid and will not be injured by rough usage, whether mechanical or electrical.

As applied to zinc accumulators, Figs. 6 and 7, sufficient space is left between the separating pieces to allow of the zinc plates G being inserted. These zinc plates are constructed so that they are quite free from pressure, being held in parts by means of insulating pieces, B, which do not, however, bear upon the zinc. These plates are formed with cores, g, of celluloid or like material, Fig. 8, which extend a little beyond the ends of the lead on which the zinc is deposited. The lead base partly surrounds these plates of celluloid, so as to form a sheath, leaving, however, projecting portions. The corners of the core which are outside the sheath are provided with small blocks, g', of celluloid or other insulating material, which serve as distance pieces. When these plates are dropped in between the peroxide plates, these distance pieces bear against those plates and keep the zinc entirely clear of any contact. There is thus no danger of zinc being deposited from the solution on any part, such deposit generally taking place when the zinc plates are in contact with any external part. In the special arrangement shown the lead base of the zinc plate does not extend completely across the celluloid, leaving a central exposed part. The central separating pieces B' bear against this part on each side and assist in holding the zinc plate.

No. 645,272—Motor Car.—William Scheu, Leeds, England. Application filed May 8, 1899.

The object of the invention is to construct motor cars so that they may be easily turned about their own centers and so that there is more control in steering than in the present construction.

Fig. 1 is a side elevation. Fig. 2 is a plan.

Wheels, A A, are placed at each side in center, and a front wheel, B, and back wheel, C. Each of the wheels B and C serves for both driving and steering and is mounted (by means of a suitable bracket, D, with spiral springs, E) on a turn

FIG. 1.

FIG. 2.

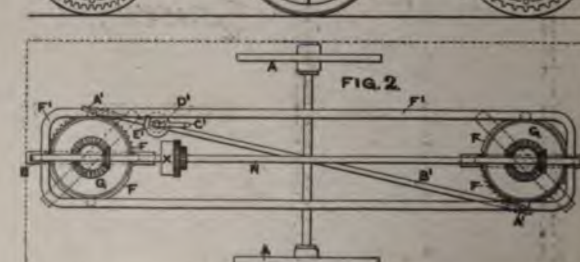


table or pivot wheel, F, which works in a fixed dished frame or casing, G, with a series of anti-friction rollers, H, thereon. In Fig. 3 only one of these rollers is shown in position. The said casing G has a central sleeve or boss, K, the turn table F being mounted loosely on the said boss and being retained in position by a split collar, L. The spindle M, which is driven from the main driving shaft N by bevel gearing, passes through and revolves within the said boss K, operating the pinion P by means of the skew-cut wheels R and S or by other suitable gearing. The said pinion P operates the driving wheel by means of a chain, T, and a chain wheel, U, on the felly, as shown applied to the back wheel C in Fig. 1, or by means of a pin wheel, V, and spur wheel, W, on the felly, as shown applied to the front wheel B in Fig. 1. The chain wheel U or spur wheel W on the felly of the driving wheel may be protected by a suitable mud guard.

The driving shaft N, from which the front and back wheels B and C are driven, is in two parts connected by differential gear X.

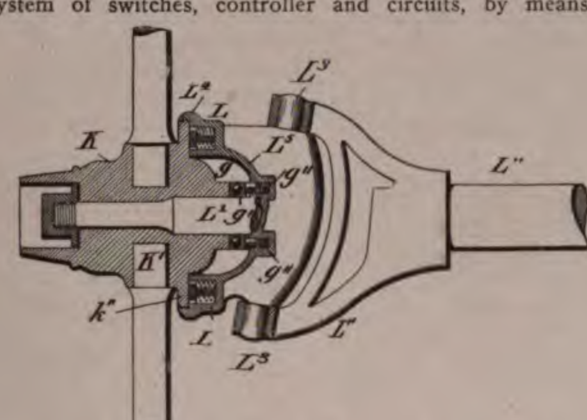
Upon preferably one-half of each turn table F are teeth gearing with worms, A', at each end of a diagonal shaft, B', which is operated from the steering handle C' by bevel wheels D' and E', one of larger diameter than the other. By this means the driving wheels B and C may be simultaneously turned in opposite directions as required in steering, as shown by dotted lines in Fig. 2, without interfering with the driving mechanism or causng any extra strain on the said driving wheels.

The casings G G, carrying the steering gear, are bolted to a suitable steel frame, F', which is secured to the body of the car in any suitable manner.

The skew wheels R R are preferably dished to give greater clearance and allow for springing of the driving wheels.

No. 645,903—Motor Vehicle Brake.—Elmer A. Sperry, Cleveland, O. March 20, 1900. Application filed Oct. 30, 1899.

The invention consists of (1) an electric brake applicable to the hubs of vehicle wheels and composed of an electro magnet, friction disk and means for retracting the magnet from the friction disk when the current is broken, and (2) a system of switches, controller and circuits, by means of



which, to effect a quick stop, the motor is converted into a generator and its self-induced current is sent through the coils of the electric brakes. In the system proposed the electric brakes are applied to the front wheels alone, the braking effect of the motor's conversion into a generator being sufficient for the rear wheels.

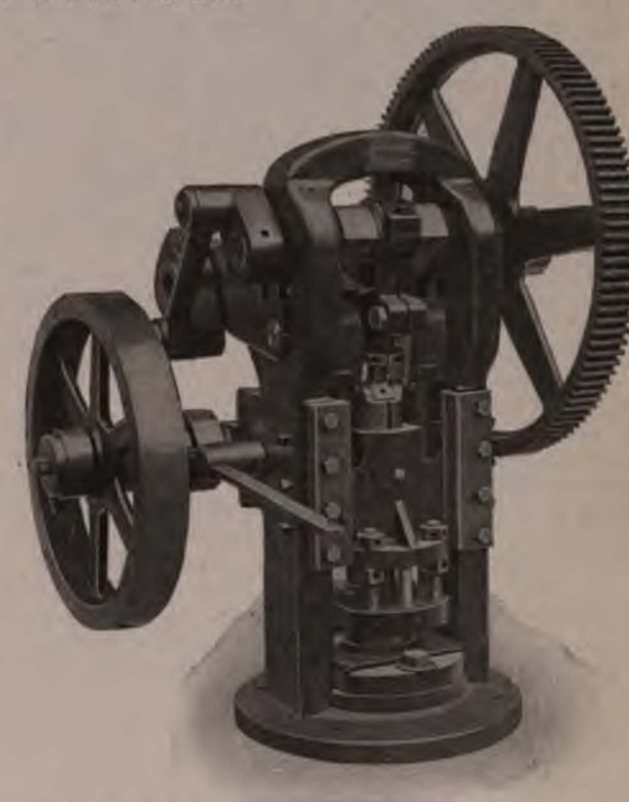
The figure shows a section of the brake, with the magnetic ring fitted to the stub axle and the springs and ball bearing collar to hold the ring in normal separation from the disk on the wheel hub.

Twelve claims.

MACHINERY and TOOLS for motor vehicle builders

The Carlson & Holmgren Toggle Drawing Press.

In the drawing press shown in the accompanying illustration, a noticeable feature is the "dwell" mechanism provided for the blank holder. The absolute and prolonged rest of the blank holder enables the drawing of very thin material. The holder comes to a full rest on the blank at the exact desired compression before the drawing plunger begins to act. This holds the metal firm while it is being drawn out, and the result is that it is relieved no more than what is just right for the perfect and uniform drawing of the material. A vast saving in the percentage of perfect work turned out is effected.



The central plunger is actuated by a crank on the main shaft in the usual manner. The blank holder is carried on an outside slide by four adjusting screws, giving adjustment for height and pressure. This slide is operated by heavy bell cranks, which in turn receive their motion from a long hinge jointed lever coupled to the short actuating lever, from which it receives a harmonic curve motion until the levers fold together, and the joint in the long lever falls concentric with the pivot of the short actuating lever. The hinged joint then opens, and the short lever and outer section of long lever go through the remaining motion of the stroke without giving any further movement to the bell crank or slide. This motion brings the blank holder to an early compression, gives a long "dwell" and late release.

These presses are made by the Waterbury Farrel Foundry & Machine Co.

Index to Volume 5.

SPECIAL NOTICES.

Advertisements inserted under this heading at $2.00 an inch for each issue, payable in advance.

ATTENTION.

Castings of Gasoline Motor described in The Explosive Motor Number of this paper. Also other sizes—stationary, marine and vehicle motors—rough or partly finished. LOWELL MODEL CO., Box 292, Lowell, Mass.

TO LEASE FOR A TERM OF YEARS.

A FACTORY within Street Car distance of a famous Summer resort, suitable for the manufacture of motor vehicles. Never failing water power, electric plant and all modern conveniences. Three floors, with basement suitable for forge shop. 5,000 square feet to each floor. Office and large show window on first floor. Brass and aluminum foundry in connection. Malleable and gray iron foundry near by. Owner willing to take an interest in a good responsible company using steam or vapor engine for motive power.

Address "FACTORY," care of THE HORSELESS AGE.

AN OPPORTUNITY.

English wagon maker and master mechanic who has had several years' practical experience in the construction of heavy steam vehicles, and who has made a success of it, believes the United States a more promising field for his labors and would like to arrange with some reliable manufacturer to enter into this branch of the motor vehicle business in America. Best of references, commercial and mechanical, furnished.

Address D. B., care of HORSELESS AGE.

STEAM VEHICLE FITTINGS.

PIN Valves (both union and plain ends), Injectors, Gasoline Regulators (improved type), Water Regulators, Improved Glass Gauges, Globe and Check Valves, Water Relief Valves for Cylinders, Steam Gauges and Safety Valves.

LOCKE REGULATOR CO., - - Salem, Mass.

3-CYLINDER, AIR COOLED MOTOR FOR SALE

Of light weight, giving ample power and simple in construction, also Transmission Gear and Compensating Gear; all attached and ready to receive the rear axles, giving two speeds ahead and backward.

B. J. CARTER, Jackson, Mich.

ELECTRIC IGNITION

IN GAS, GASOLINE AND OIL ENGINES.

We make special SPARKING POINTS for this service possessing extreme hardness and greater durability than platinum.

SEND FOR DESCRIPTIVE MATTER AND PRICES.

BAKER & CO., Manufacturers of Platinum Products, **NEWARK, N. J.**

Subscribers who are willing to act as

LOCAL SUBSCRIPTION AGENTS

for THE HORSELESS AGE, on a commission basis, are requested to communicate with the Editor.

FOR EXCHANGE.

I want a good second-hand electric vehicle in exchange for my gasoline carriage. Give full description and state condition, value and where to be seen. "BARTLETT," care of HORSELESS AGE.

Gentleman going abroad will sell No. 1. Locomobile for Six Hundred Dollars. In perfect condition, only run about one hundred miles. Address FOREIGN, care of HORSELESS AGE.

WANTED.

A tricycle, quadricycle or light Decauville carriage, De Dion & Bouton preferred. Must be in good condition and price must be low.

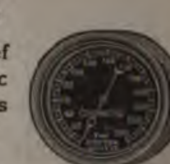
Address, W. R. BULLIS,

CHATHAM, N. Y.

...ASHTON...

Pop Safety Valves, Cylinder Relief Valves, Steam Gauges, Automatic Water Gauges and Gauge Cocks for

STEAM VEHICLES.



THE ASHTON VALVE CO., 271 Franklin St., Boston, Mass.

BRANCHES: 121 Liberty Street, New York.
1218 Filbert Street, Philadelphia.
218 Lake Street, Chicago, Ill.

Automobile Storage and Repair Co.

Station No. 1—57 WEST 66th STREET (St. Nicholas Rink Bldg.), NEW YORK.

House and Care for Automobiles of all kinds. Storage Batteries Charged and Supplies of all kinds furnished.

Transients Accommodated.

Any of our subscribers who are willing to solicit subscriptions for THE HORSELESS AGE from their fellow townsmen are requested to communicate with the Editor, as we are desirous of entering into business relations with such parties.

Phineas Jones & Co.

Reputation.. International

ALL KINDS OF

WOOD WHEELS

FOR AUTOMOBILES.

ESTABLISHED 1855. NEWARK, N. J.

SEND FOR SOUVENIR STAMP BOX.

THE BALL BEARING CO.

BOSTON, MASS.

WE MAKE BEARINGS

FOR MOTOR VEHICLES.

GET OUR CATALOG.

MOST RELIABLE ENGINE.
BEST REVERSING SCREW.

Also Fine, Strong, Mechanical Reverse.

FULL line of Superior Engines suitable for Motor Carriages. We supply Running Gear, Differential Axles, Wheels and Parts for Automobiles. . . . .

SOLD SEPARATE OR TOGETHER.

SEND 50 cents for Pasteboard Working Model describing our Engine and Showing Valve Motion.

We are building and are prepared to take orders for

AUTOMOBILE BUSSES ☙ ☙ ☙

DENISON ELECTRICAL ENGINEERING CO., NEW HAVEN, CT., U. S. A.

VOLUME FOUR COMPLETE.

(April 5th to September 27th, 1899, inclusive.)

To New Subscribers for Two Years.

We wish to place these volumes in the hands of persons permanently interested and therefore offer them only to those who will subscribe for two years from April 5th, 1899. :: :: ::

SEND $4 AND GET THIS VOLUME BEFORE IT IS EXHAUSTED.

GOOD ROADS LITERATURE.

Send for a copy of "A Plea for Good Roads," containing addresses of speakers at the recent Good Roads meeting of the Automobile Club of America, and use it in the cause. . . . .

ALBERT R. SHATTUCK, Chairman.
Good Roads Committee,
Waldorf-Astoria, New York.

TRANSMISSION GEARING. . . . FOR AUTOMOBILES

Patents Allowed.

RUNABOUT SIZE. Weight Complete, 35 lbs.

COLCORD UPTON, BEVERLY, MASS.

Copyrighted, Pettingill, N. Y.

VOLUME 5 OCTOBER 11, 1899 NUMBER 2

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

STANHOPE PHAETON, 4 H. P. MOTOR.

THE AUTOMOBILE CO. OF AMERICA.

Manufacturers of

MOTOR VEHICLES,

HYDRO-CARBON SYSTEM.

FOUR OR FIVE DIFFERENT TYPES for pleasure and business on exhibition.

HUDSON BUILDING, NEW YORK.

SHELBY SEAMLESS COLD DRAWN STEEL TUBING

For Automobile Vehicle Construction in Running Gear and Hollow Axles.

SEAMLESS TUBING

FOR PISTON RODS AND CYLINDERS.

Write for Price List "E" for guide and reference. Can furnish tables giving Safe Load in pounds at centers, "Moduli" of sections and Safe Twisting Moment.

ADDRESS:

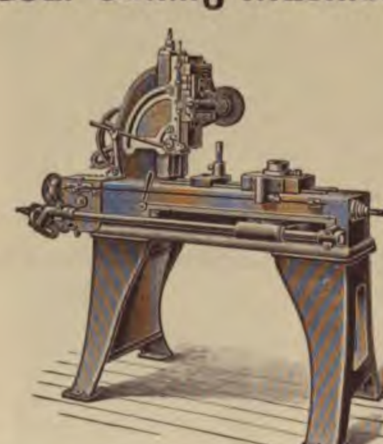
SHELBY STEEL TUBE COMPANY,

General Sales Offices: CLEVELAND, OHIO, U. S. A.

BRANCH OFFICES:

144 Chambers St., New York, N. Y. 135 Lake St., Chicago, Ill. 29 Constitution Hill, Birmingham, England.

The Whiton Universal Automatic Gear Cutting Machine.



Most complete **Gear Cutter** yet designed. Specially adapted to the requirements of Motor Vehicle Manufacturers. Already in use in several leading shops.

SEND FOR FULL PARTICULARS AND LIST OF USERS.

THE D. E. WHITON MACHINE CO.

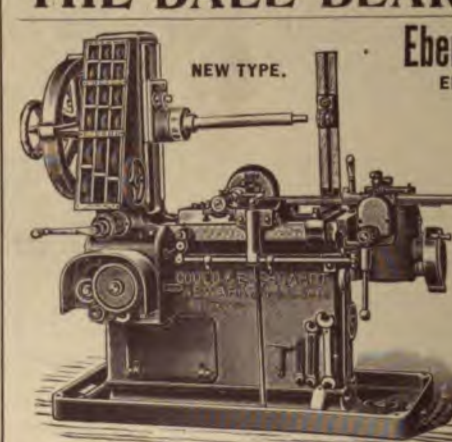
NEW LONDON, CONN., U. S. A.

ROLLER BEARINGS.

MADE BY

BOSTON, MASS.

THE BALL BEARING CO.



"VICTORIA."

24 in., 33 in., 43 in., 63 in., 73 in. and 103 in.

Eberhardt's Patent

ENTIRELY AUTOMATIC

GEAR CUTTING MACHINES

WITH

Eberhardt's Patent

"Radial Duplex" Gang Cutters.

2 to 10 teeth finished at once.

GOULD & EBERHARDT,

NEWARK, N. J.

VOLUME 5 OCTOBER 18, 1899 NUMBER 3

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

VOLUME 5 OCTOBER 25, 1899 NUMBER 4

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,
NEW YORK.

VOLUME 5 NOVEMBER 1, 1899 NUMBER 5

The Horseless Age

EVERY WEDNESDAY

In the Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

LOOK FOR THE STEAM BOILER NUMBER,
December 6th.

THE AMERICAN MOTOR CO.

Lightest, Strongest, Simplest Motor Made.

Runs with Gasoline, Kerosene or Gas.

FROM 1 TO 30 H. P.

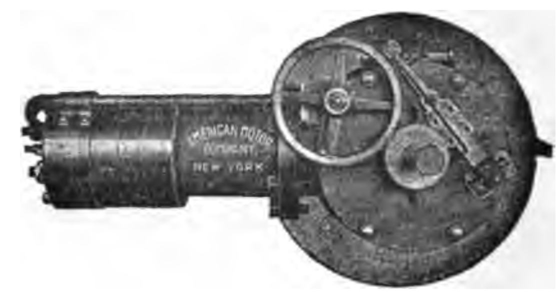
IGNITION OUTFITS

Consisting of AMERICAN COIL, IGNITION PLUG and SPECIAL PRIMARY or STORAGE BATTERIES; only absolutely reliable method of sparking small motors . .

ALSO MANUFACTURERS OF

SPECIAL WIRE WHEELS, REAR AXLES, DIFFERENTIALS, CLUTCHES, STEERING APPARATUS, ETC., FOR MOTOR VEHICLES.

AMERICAN MOTOR CO., - - 32 Broadway, NEW YORK.



No. 2, 3½ B. H. P.

SHELBY SEAMLESS COLD DRAWN STEEL TUBING

For Automobile Vehicle Construction in Running Gear and Hollow Axles.

SEAMLESS TUBING

FOR PISTON RODS AND CYLINDERS.

Write for Price List "E" for guide and reference. Can furnish tables giving Safe Load in pounds at centers, "Moduli" of sections and Safe Twisting Moment.

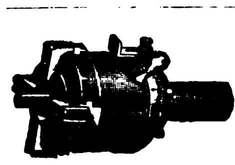
ADDRESS:

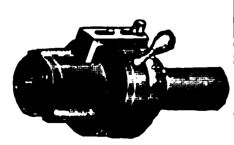
SHELBY STEEL TUBE COMPANY,

General Sales Offices: CLEVELAND, OHIO, U. S. A.

BRANCH OFFICES:

144 Chambers St., New York, N. Y. 135 Lake St., Chicago, Ill. 29 Constitution Hill, Birmingham, England.





THE

GEOMETRIC LINE

Of tools for screw machine work are used and recommended by all leading manufacturers because they possess so many points of superiority over old methods.

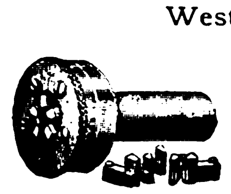
If you are interested in screw machine work of any kind it will pay you to investigate this line of

Adjustable Self-Opening Screw Cutting Die Heads, Adjustable Collapsing Taps, and Adjustable Hollow Milling Tools,

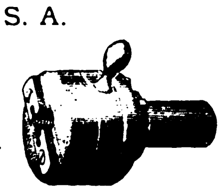
Manufactured by the

GEOMETRIC DRILL CO.,

Westville, Conn., U. S. A.



DESCRIPTIVE MATTER ON DEMAND.



EAMES MOTOR WHEEL.

A practical, durable wheel, neat in appearance.

Made from the Best Hickory. **Any Tire or Axle can** be applied, as the centres of the hub are wood, covered by iron.

Send us your channels, we will set them free of charge.

PRICE PER SET OF 4, for any size up to 1⅛ axle. **$17.** Over that size prices quoted.

A. M. Eames & Co.

South Framingham, Massachusetts.

"Builders of the Best Vehicle Wheels in America."

VOLUME 5 NOVEMBER 8, 1899 NUMBER 6

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

STANHOPE PHAETON, 4 H. P. MOTOR.

THE AUTOMOBILE CO. OF AMERICA.

Manufacturers of

MOTOR VEHICLES,

HYDRO-CARBON SYSTEM.

FOUR OR FIVE DIFFERENT TYPES for pleasure and business on exhibition.

HUDSON BUILDING, NEW YORK.

SHELBY SEAMLESS COLD DRAWN STEEL TUBING

For Automobile Vehicle Construction in Running Gear and Hollow Axles.

SEAMLESS TUBING

FOR PISTON RODS AND CYLINDERS.

Write for Price List "B" for guide and reference. Can furnish tables giving Safe Load in pounds at centers, "Moduli" of sections and Safe Twisting Moment.

ADDRESS:

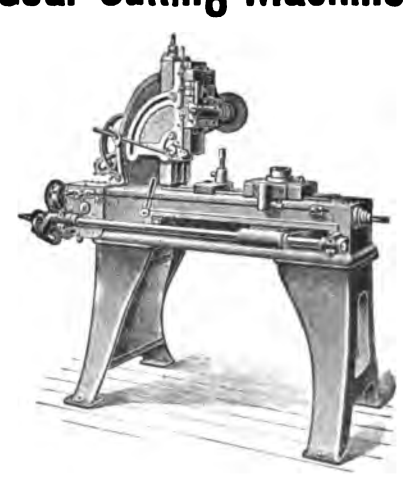
SHELBY STEEL TUBE COMPANY,

General Sales Offices: CLEVELAND, OHIO, U. S. A.

BRANCH OFFICES:

144 Chambers St., New York, N. Y. 135 Lake St., Chicago, Ill. 29 Constitution Hill, Birmingham, England.

The Whiton Universal Automatic Gear Cutting Machine.



Most complete **Gear Cutter** yet designed. Specially adapted to the requirements of Motor Vehicle Manufacturers. Already in use in several leading shops.

SEND FOR FULL PARTICULARS AND LIST OF USERS.

THE D. E. WHITON MACHINE CO.
NEW LONDON, CONN., U. S. A.

The Leach Motor Vehicle Co. is now booking orders for spring delivery, for its steam motor carriages. Three patterns are offered, viz.:

A two-seated mail phaeton, convertible to single seat. It is a finely finished, substantial family carriage, carrying two to six persons.

A light, road Stanhope runabout wagon built for speed on good roads and guaranteed equal to any now on the market and built **to last.**

A handsome delivery wagon for grocers, dry goods dealers, etc. Built for service and very rich and elegant in design.

We also offer Burners, Gears (including Differentials and Steering Mechanism), Engines, Boilers, etc., to the trade.

Address

Leach Motor Vehicle Co.,

210 Broadway, Everett, Mass.

Cable Address, "Leachmotor," Boston, U. S. A.
"A B C" Code used.

VOLUME 5 NOVEMBER 15, 1899 NUMBER 7

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,
NEW YORK.

LOOK FOR THE STEAM BOILER NUMBER,
December 6th.

THE AMERICAN MOTOR CO.

Lightest, Strongest, Simplest Motor Made.

Runs with Gasoline, Kerosene or Gas.

FROM 1 TO 30 H. P.

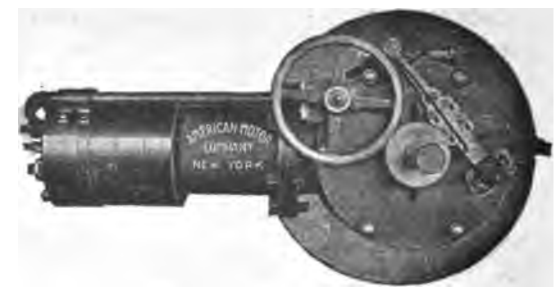
IGNITION OUTFITS

Consisting of AMERICAN COIL, IGNITION PLUG and SPECIAL PRIMARY or STORAGE BATTERIES; only absolutely reliable method of sparking small motors . .

ALSO MANUFACTURERS OF

SPECIAL WIRE WHEELS, REAR AXLES, DIFFERENTIALS, CLUTCHES, STEERING APPARATUS, ETC., FOR MOTOR VEHICLES.

AMERICAN MOTOR CO., - - 32 Broadway, NEW YORK.



No. 2, $3\frac{1}{2}$ B. H. P.

SHELBY SEAMLESS COLD DRAWN STEEL TUBING

For Automobile Vehicle Construction in Running Gear and Hollow Axles.

SEAMLESS TUBING

FOR PISTON RODS AND CYLINDERS.

Write for Price List "E" for guide and reference. Can furnish tables giving Safe Load in pounds at centers, "Moduli" of sections and Safe Twisting Moment.

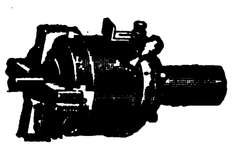
ADDRESS:

SHELBY STEEL TUBE COMPANY,

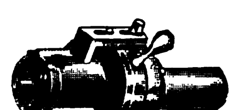
General Sales Offices: CLEVELAND, OHIO, U. S. A.

BRANCH OFFICES:

144 Chambers St., New York, N. Y. 135 Lake St., Chicago, Ill. 29 Constitution Hill, Birmingham, England.



THE



GEOMETRIC LINE

Of tools for screw machine work are used and recommended by all leading manufacturers because they possess so many points of superiority over old methods.

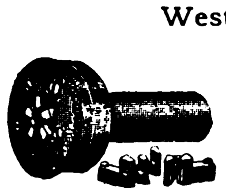
If you are interested in screw machine work of any kind it will pay you to investigate this line of

Adjustable Self-Opening Screw Cutting Die Heads, Adjustable Collapsing Taps, and Adjustable Hollow Milling Tools,

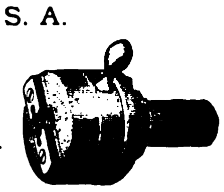
Manufactured by the

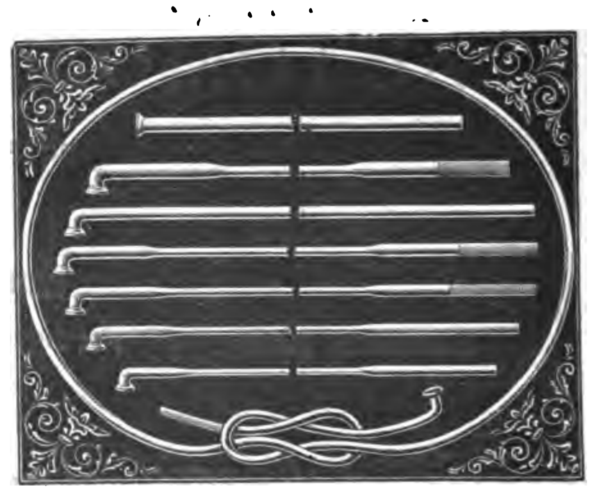
GEOMETRIC DRILL CO.,

Westville, Conn., U. S. A.



DESCRIPTIVE MATTER ON DEMAND.





MORSE-KEEFER CO., SALISBURY, CONN.,

NICKEL STEEL

MOTOR CARRIAGE SPOKES.

SWAGED—to any desired gauge. Nipples to fit.

IVEN-BRANDENBURG CO., Sole U. S. Selling Agents,

NEW YORK: 56 Reade Street.

CHICAGO: 131-133 Lake Street.

VOLUME 5 NOVEMBER 22, 1899 NUMBER 8

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

LOOK FOR THE STEAM BOILER NUMBER,
December 6th.

VOLUME 5 NOVEMBER 29, 1899 NUMBER 9

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 **Foreign $3.00** **Single Copies, 10 Cents.**

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,
NEW YORK.

LOOK FOR THE STEAM BOILER NUMBER,
December 6th.

VOLUME 5 DECEMBER 6, 1899 NUMBER 10

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

STEAM BOILER NUMBER.

VOLUME 5 DECEMBER 13, 1899 NUMBER 11

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

LOOK FOR THE EXPLOSIVE MOTOR NUMBER
JANUARY 17TH.

VOLUME 5 DECEMBER 20, 1899 NUMBER 12

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

LOOK FOR THE EXPLOSIVE MOTOR NUMBER
JANUARY 17TH.

VOLUME 5 DECEMBER 27, 1899 NUMBER 13

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

**LOOK FOR THE EXPLOSIVE MOTOR NUMBER
JANUARY 17TH.**

VOLUME 5 JANUARY 3, 1900 NUMBER 14

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

LOOK FOR THE EXPLOSIVE MOTOR NUMBER
JANUARY 17TH.

VOLUME 5 JANUARY 10, 1900 NUMBER 15

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

LOOK FOR THE EXPLOSIVE MOTOR NUMBER
JANUARY 17TH.

VOLUME 5 DECEMBER 20, 1899 NUMBER 12

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

LOOK FOR THE EXPLOSIVE MOTOR NUMBER JANUARY 17TH.

STANHOPE PHAETON, 4 H. P. MOTOR.

THE AUTOMOBILE CO. OF AMERICA.

Manufacturers of

MOTOR VEHICLES,

HYDRO-CARBON SYSTEM

FOUR OR FIVE DIFFERENT TYPES for pleasure and business on exhibition.

HUDSON BUILDING, NEW YORK.

SHELBY SEAMLESS COLD DRAWN STEEL TUBING

For Automobile Vehicle Construction in Running Gear and Hollow Axles.

SEAMLESS TUBING

FOR PISTON RODS AND CYLINDERS.

Write for Price List "E" for guide and reference. Can furnish tables giving Safe Load in pounds at centers, "Moduli" of sections and Safe Twisting Moment.

ADDRESS:

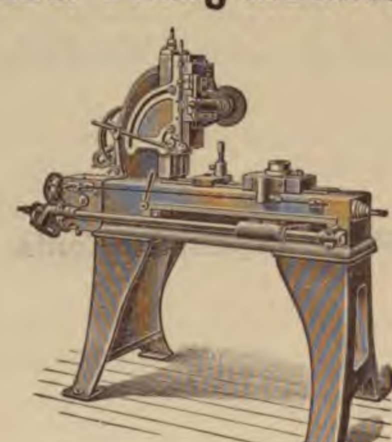
SHELBY STEEL TUBE COMPANY,

General Sales Offices: CLEVELAND, OHIO, U. S. A.

BRANCH OFFICES:

144 Chambers St., New York, N. Y. 135 Lake St., Chicago, Ill. 29 Constitution Hill, Birmingham, England.

The Whiton Universal Automatic Gear Cutting Machine.



Most complete Gear Cutter yet designed. Specially adapted to the requirements of Motor Vehicle Manufacturers. Already in use in several leading shops.

SEND FOR FULL PARTICULARS AND LIST OF USERS.

THE D. E. WHITON MACHINE CO.

NEW LONDON, CONN., U. S. A.

The Leach Motor Carriage

is a steam carriage—the world's universal and best-understood motive power. We have resisted the temptation to build too light, although the carriage is not heavy enough to be unwieldy in appearance or action. It is not a "cheap" carriage but a "good" carriage of the very best and most thorough workmanship all through. . . . .

CATALOGUE FREE.

LEACH MOTOR VEHICLE CO.,

210 Broadway, Everett, Mass.

VOLUME 5 DECEMBER 27, 1899 NUMBER 13

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

LOOK FOR THE EXPLOSIVE MOTOR NUMBER JANUARY 17TH.

VOLUME 5 JANUARY 3, 1900 NUMBER 14

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

LOOK FOR THE EXPLOSIVE MOTOR NUMBER
JANUARY 17TH.

VOLUME 5 JANUARY 10, 1900 NUMBER 15

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

LOOK FOR THE EXPLOSIVE MOTOR NUMBER
JANUARY 17TH.

[redacted]

VOLUME 5 JANUARY 17, 1900 NUMBER 16

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,
NEW YORK.

EXPLOSIVE MOTOR NUMBER.


AUTOMOBILE CO. OF AMERICA.
OFFICE 32 BROADWAY N.Y.

VOLUME 5 JANUARY 24, 1900 NUMBER 17

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

VOLUME 5 JANUARY 31, 1900 NUMBER 18

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

VOLUME 5 FEBRUARY 7, 1900 NUMBER 19

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

VOLUME 5 FEBRUARY 14, 1900 NUMBER 20

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

VOLUME 5 FEBRUARY 21, 1900 NUMBER 21

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,
NEW YORK.

VOLUME 5 FEBRUARY 28, 1900 NUMBER 22

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

VOLUME 5 MARCH 7, 1900 NUMBER 23

The Horseless Age

EVERY WEDNESDAY

In the Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

LOOK FOR THE ACETYLENE MOTOR NUMBER.

VOLUME 5 MARCH 14, 1900 NUMBER 24

The Horseless Age

EVERY WEDNESDAY

In the
Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

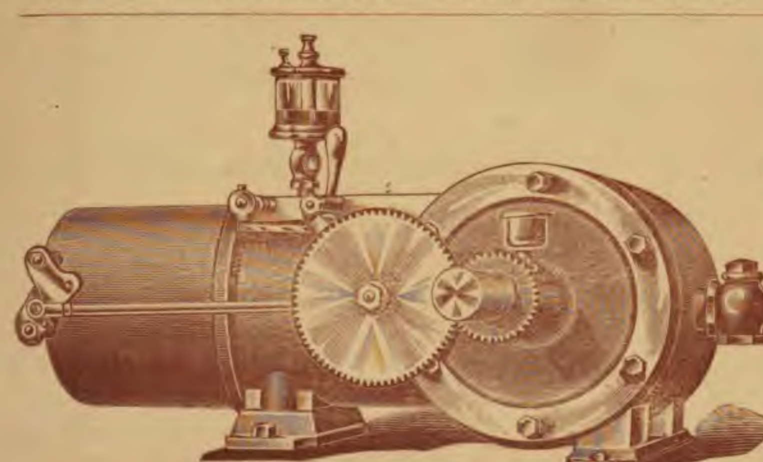
SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,
NEW YORK.

LOOK FOR THE ACETYLENE MOTOR NUMBER.



VOLUME 5 MARCH 28, 1900 NUMBER 26

The Horseless Age

EVERY WEDNESDAY

In the Interest of the

AUTOMOBILE INDUSTRY.

ESTABLISHED 1895.

SUBSCRIPTION

Domestic $2.00 Foreign $3.00 Single Copies, 10 Cents.

OFFICE OF PUBLICATION

American Tract Society Building, Nassau and Spruce Streets,

NEW YORK.

LOOK FOR THE ACETYLENE MOTOR NUMBER.